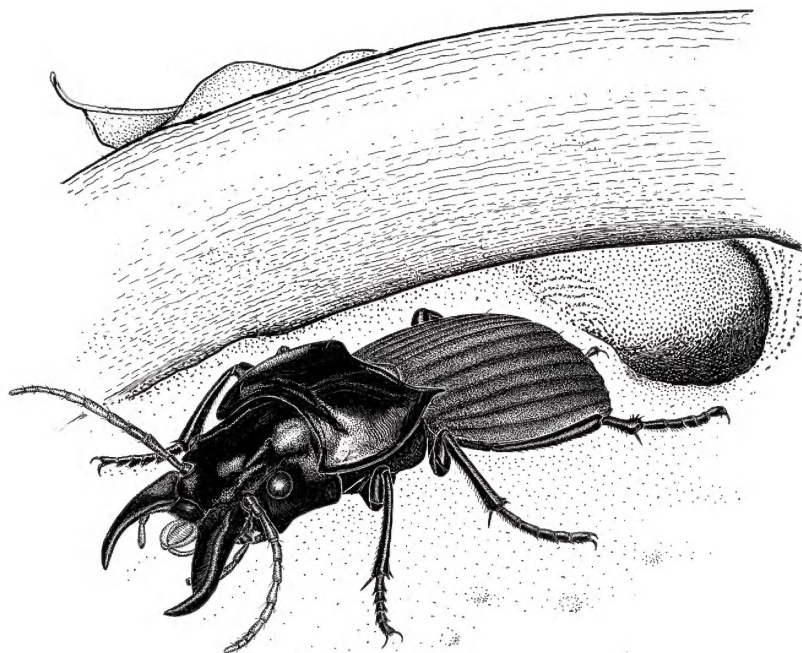


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COVER

The giant wingless carabid, *Nurus rex* Darlington 1961, at the entrance to its burrow under a rainforest tree root. The species occurs only in a small cap of rainforest on the summit of the 1000 m Mt Elliot, just south of Townsville, and was first collected by the noted Harvard biogeographer, Philip Darlington, when he made the first entomological ascent of the mountain in March 1958. It is the largest and most northerly of about a dozen species in its genus, all of which are now known to live in burrows with a cleared entrance court where they ambush passing invertebrates at night. Pen and ink drawing by Caloundra ESQ member, Dr Albert Orr, whose illustrated books on dragonflies and butterflies have won awards in Australia and overseas.

NEW SPECIES AND RECORDS OF *DIPLOCHORDA* OSTEN SACKEN (DIPTERA: TEPHRITIDAE: PHYTALMIINAE) FROM THE ISLAND OF NEW GUINEA

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Abstract

Three new species of *Diplochorda* Osten Sacken are described from New Guinea: *D. buloloe* sp. n. and *D. macalpinei* sp. n. from Papua New Guinea and *D. mimika* sp. n. from Papua Province, eastern Indonesia. The males of *D. myrmex* Osten Sacken and *D. ophion* Osten Sacken are newly recorded and additional localities are noted for them, *D. aneura* Malloch, *D. brevicornis* (Saunders), *D. concisa* (Walker), *D. minor* Malloch, *D. trilineata* de Meijere and *D. unistriata* Malloch. Records of *D. australis* Permkam & Hancock from Papua New Guinea are referred to *D. buloloe*, with *D. australis* thus confined to the Iron Range area of northern Queensland. A key to the 12 known species of *Diplochorda* is included.

Introduction

The genus *Diplochorda* Osten Sacken, 1881 was reviewed and keyed by Hancock (2016). As a result, it became possible to identify unsorted material in the Natural History Museum, London (NHMUK, formerly BMNH: specimen numbers NHMUK010579879 to 010579889) that, together with material in the Australian Museum, Sydney (AM) and Queensland Museum, Brisbane (QM), has resulted in the new species and new distribution records presented below. Twelve species of *Diplochorda* are now known, with the genus confined to the main island of New Guinea and the adjacent Salawati and Japen Islands, plus northeastern Australia.

New species

Diplochorda buloloe sp. n.

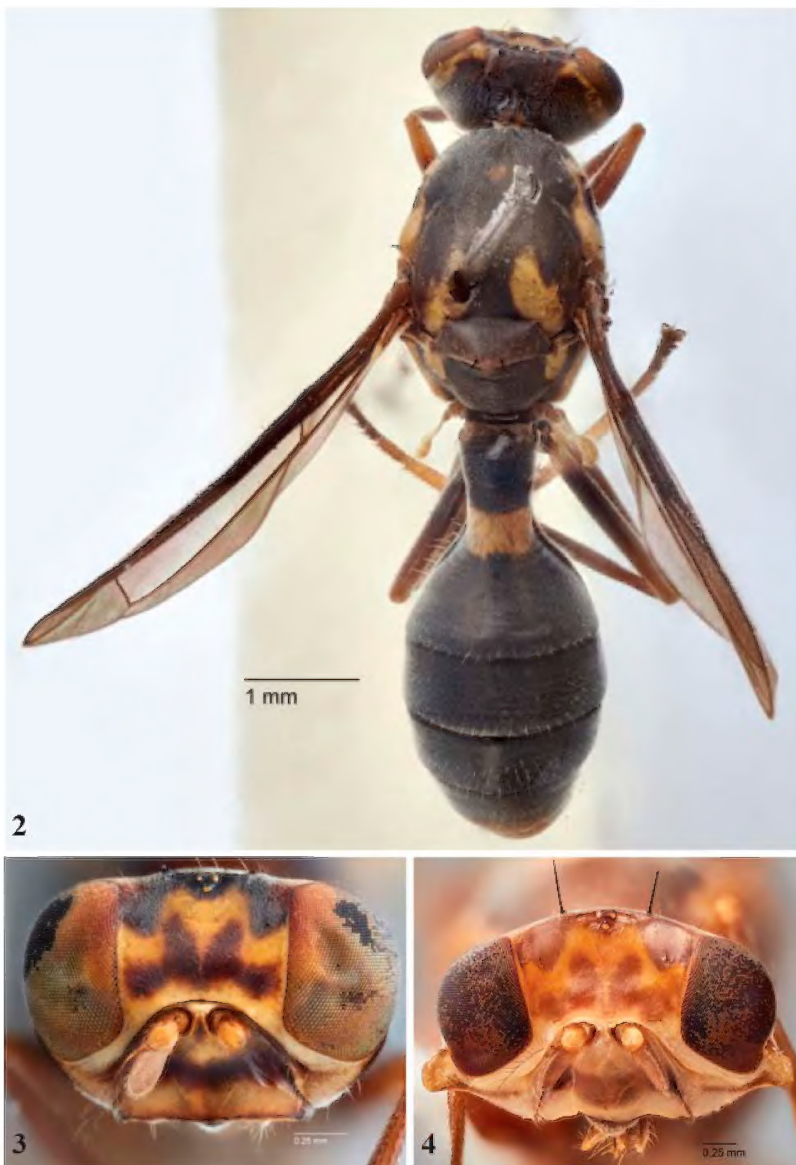
(Figs 1-6)

Type material. Holotype ♀, PAPUA NEW GUINEA (MOROBE PROVINCE): 'under *Musa* leaf, Stony Logging Area, near Bulolo, PNG, 2.viii.1979, H. Roberts' / '1122' (in AM: K493858). Paratype ♂, same data as holotype except '1122/E' (in AM: K493857).

Description. Female (Figs 1-2). Length (excluding ov scape) 6.9 mm; wing 6.4 mm. Head about as high as long and largely fulvous; 1 frontal, 2 weak orbitals, the upper weaker, 1 strong vertical and a row of thin black postocular setae. Frons (Fig. 3) very broad, with a pair of black submedial oval and anterolateral rounded markings connected anteriorly and black areas surrounding the orbital setae connected to occipital black area posteriorly. Face (Fig. 3) distinctly concave, fulvous with a black medial band equidistant from antennal bases and epistome. Antenna fulvous, about half length of face, with third segment apically rounded and about 2.5 times length of second segment; arista plumose. Gena weakly expanded and eye margin slightly constricted. Occiput black except narrowly yellow along eye margin.



Fig. 1. *Diplochorda buloloae* sp. n., holotype female, lateral view. Photo by Geoff Thompson © Queensland Museum, Brisbane.



Figs 2-4. *Diplochora buloloae* sp. n: (2) holotype female, dorsal view; (3) holotype female, face and frons; (4) paratype male, face and frons. Photos by Geoff Thompson © Queensland Museum, Brisbane.

Thorax (Figs 1-2) with scutum black with yellow areas as follows: posterior two-fifths of postpronotal lobe; notopleural lobe; an indistinct medial spot just anterior to line of suture; a pair of posterolateral vittae broadly separated by black medial area, reaching about half way to suture anteriorly and directed laterally posteriorly; upper half of anatergite (remainder black); katatergite; a narrow band connecting postpronotal lobe and notopleural callus, continuing as a narrow stripe across posterodorsal corner of anepisternum and vertically over anepimeron and onto sternopleuron as a narrow spot. Remainder of pleura and sternum black. Scutellum blackish brown, with 1 pair of apical setae. Mediotergite black with yellow anterolateral spots. Haltere dark fulvous.

Legs (Fig. 1) largely blackish-brown; fore femur fulvous over basal quarter; mid femur fulvous over basal sixth; hind femur red-brown, fulvous over basal fifth; mid and hind tarsi with first segment fulvous on inner surface, fuscous on outer surface; mid tibia with 1 long and 2 short apical spines.

Wing (Fig. 5) hyaline with a brown costal band reaching but not crossing vein R_{4+5} and a faint infuscation in cell cu_1 that does not form a distinct dark band along vein Cu_1 ; cell bcu apically acute but not extended into a lobe; venation typical of genus, with vein M strongly arcuate and cell dm hatchet-shaped.

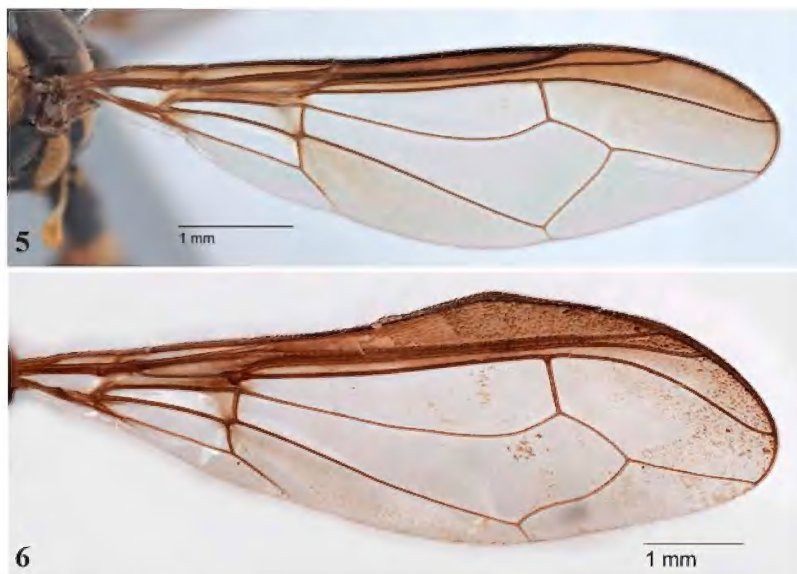
Abdomen (Fig. 2) narrowly petiolate; tergites I+II large, black with a narrow yellow medial band separated from hind margin by about twice its own length; tergites III-VI black except tergite V weakly fulvous along posterior margin and tergite VI broadly fulvous posteromedially. Oviscape (Fig. 1) red-brown, narrowing and tubular posteriorly, about as long as tergites IV-VI.

Male. Similar to female except: head with genal processes broad and well developed (Fig. 4); scutum with yellow anterior spot larger and expanded laterally by fulvous areas (due to tenacity?); scutum with yellow posterolateral vittae slightly larger; costa strongly arched (Fig. 6); mediotergite broadly fulvous medially in addition to anterolateral yellow spots; abdomen shrivelled and characters not discernible.

Etymology. Named after the township of Bulolo, close to the type locality.

Distribution. Known only from Morobe Province, Papua New Guinea.

Comments. The male abdomen is damaged and shrivelled; hence the female, which is in good condition, is selected as the holotype. This species closely resembles *D. australis* Permkam & Hancock from NE Queensland and *D. brevicornis* (Saunders) from West Papua Province, Indonesia and previous records of the former from Papua New Guinea (Permkam and Hancock 1995, Hancock 2016) are misidentifications of *D. buloloae*. It differs from *D. australis* in the reduced yellow areas on the scutum and from both species in the lack of a distinct brown band in wing cell cu_1 along vein Cu_1 .



Figs 5-6. *Diplochorda buloloae* sp. n., wings: (5) holotype female; (6) paratype male. Photos by Geoff Thompson © Queensland Museum, Brisbane.

***Diplochorda macalpinei* sp. n.**

(Figs 7-10)

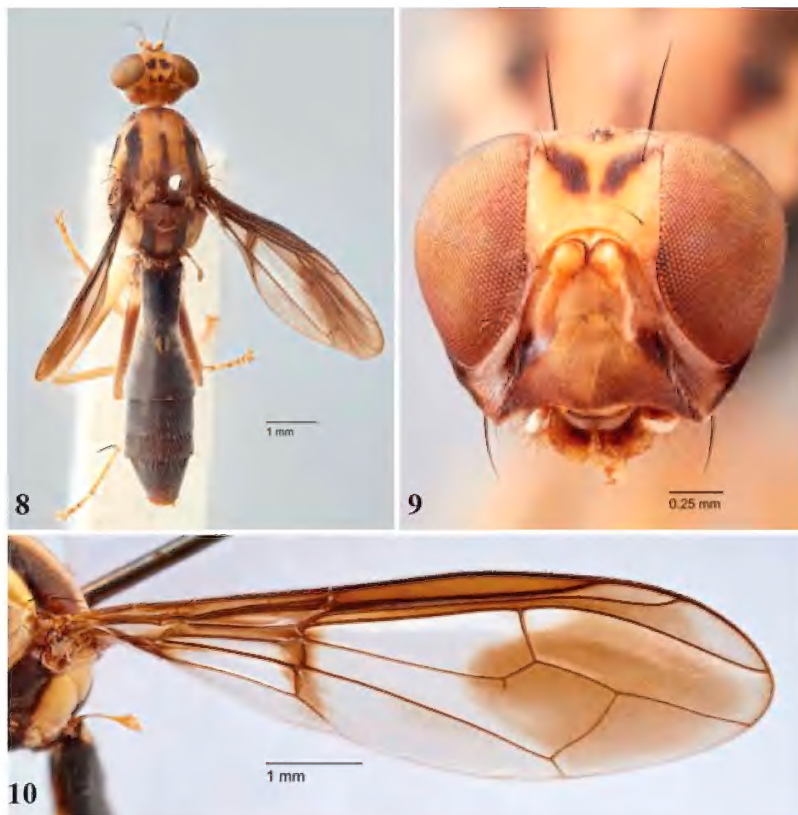
Type material. Holotype ♂, PAPUA NEW GUINEA (EAST SEPIK PROVINCE): 'Imbia, near Maprik, TPNG, 18.xii.1963, D.K. McAlpine' / '*Diplochorda* sp. B wing' (in AM: K493829).

Description. Male (Figs 7-8). Length 8.8 mm; wing 7.1 mm. Head higher than long and largely fulvous; 1 frontal, 2 weak orbitals, the upper weaker, 1 strong vertical and a row of thin black postocular setae. Frons (Fig. 9) broad with a pair of isolated, blackish brown crescent-shaped markings medially that are well separated from anterior margin and faintly reach eye margin over orbital setae. Face (Fig. 9) fulvous and distinctly concave, with epistomal margin slightly darker and a pair of oblique blackish brown spots laterally. Antenna dark fulvous, about half length of face, with third segment apically rounded and about 2.5 times length of second segment; arista plumose. Gena weakly expanded as a narrow ridge and with a black stripe from lower, slightly constricted eye margin to epistome; seta present. Occiput dark fulvous, paler along eye margin around postocular setae.

Thorax (Figs 7-8) with scutum orange-brown with broad lateral and narrow medial black vittae, the medial vitta broadly interrupted anterior to line of suture and broadening towards posterior margin. Yellow areas are as follows:



Fig. 7. *Diplochorda macalpinei* sp. n., holotype male, lateral view. Photo by Geoff Thompson © Queensland Museum, Brisbane.



Figs 8-10. *Diplochorda macalpinei* sp. n., holotype male: (8) dorsal view; (9) face and frons; (10) wing. Photos by Geoff Thompson © Queensland Museum, Brisbane.

posterior half of postpronotal lobe (anterior half dark brown); notopleural lobe; a narrow band connecting postpronotal lobe and notopleural lobe, continuing as a narrow stripe across dorso-posterior corner of anepisternum and vertically over anepimeron and onto sternopleuron as a narrow spot; anatergite and katatergite; posterolaterally on scutum. Remainder of pleura and sternum black. Single black setae on notopleural lobe and anepisternum. Scutellum dark brown, with 1 pair of apical setae. Postscutellum and mediotergite black with a broad fulvous medial stripe. Haltere dark fulvous.

Legs (Fig. 7) mostly pale fulvous; fore and mid femora darker fulvous medially, hind femur brown over medial three-fifths, fulvous over basal and apical fifths; tibiae and tarsi fulvous to dark fulvous; mid tibia with 1 long and 2 short apical spines.

Wing (Fig. 10) with brown costal band reaching vein R_{4+5} and expanding broadly across apex to include all except anteroapical corner of cell r_{4+5} , posteroapical corner of cell br , apical part of cell dm except along vein Cu_1 and cell m almost to apex of vein Cu_1 but not extending into cell cu_1 , leaving that cell almost entirely hyaline except for a narrow brown band at base that connects with the costal band over $BM-Cu$ crossvein; apical margin of brown apical area subhyaline. Costal cells brown. $R-M$ crossvein separated from $DM-Cu$ crossvein by less than twice its own length. Cell bcu apically acute but not extended into a lobe. Costa weakly arched; vein M with a short spur vein extending into cell dm basal to $R-M$ crossvein.

Abdomen (Figs 7-8) broadly petiolate; tergites I+II large and distinctly longer than terga III-V combined, black with a small medial yellow spot divided by a black vitta and a narrow medial yellow stripe on lateral margin (Fig. 7); tergites III-V black except tergite V weakly fulvous posteromedially. Genitalia fulvous; not dissected.

Female unknown.

Etymology. Named after Dr David McAlpine (Australian Museum, Sydney), who collected the only known specimen and has made major contributions to the study of Australasian Diptera.

Distribution. Known only from the type locality in East Sepik Province.

Comments. The wing pattern of *D. macalpinei* most resembles that of *D. mimika* sp. n. but, despite its very different wing pattern, it appears to be most closely related to *D. ophion* Osten Sacken, particularly in the orange-brown scutum with a narrow black medial vitta, mostly yellow face and legs and broadly petiolate abdomen. In *D. mimika* the scutal vittae are broader, the face black, the legs largely fuscous and the abdomen narrowly petiolate.

***Diplochorda mimika* sp. n.**

(Figs 11-16)

Type material. Holotype ♀, INDONESIA (PAPUA PROVINCE): 'Dutch New Guinea: Mimika River, vii.1910, A.F.R. Wollaston, 1911-229' / '*Diplochorda* ? new sp., D.K. McAlpine det.' (in NHMUK: NHMUK010579879).

Description. Female (Figs 11-16). Length (excluding oviscapae) 8.8 mm; wing 7.3 mm. Head (Figs 13-15) higher than long and largely fulvous; 1 frontal, 2 weak orbitals, the upper weaker, 1 strong vertical and a row of thin black postocular setae. Frons broad with a pair of black, crescent-shaped longitudinal markings. Face black and distinctly concave. Antenna brown, about half length of face, with third segment apically rounded and about 2.5 times length of second segment; [arista abraded]. Gena weakly expanded and with a black stripe from lower, slightly constricted eye margin to epistome; seta present. Lower occiput fuscous; upper occiput narrowly black behind ocellar triangle almost to eye margin.



Figs 11-14. *Diplochorda mimika* sp. n., holotype female: (11) lateral view; (12) dorsal view; (13) head, dorsal view; (14) head, frontal view. Photos © Natural History Museum, London.



Figs 15-16. *Diplochorda mimika* sp. n., holotype female: (15) lateral view of head and thorax; (16) wing. Photos © Natural History Museum, London.

Thorax (Figs 12, 15) with scutum red-brown with three broad medial and lateral black vittae, the lateral pair not reaching hind margin, the medial narrowing posteriorly and interrupted anterior to suture. Yellow areas as follows: posterior half of postpronotal lobe (remainder brown); notopleural lobe; posterior two-fifths of scutum except for medial vitta; anatergite and katatergite; a narrow band connecting postpronotal lobe and notopleural lobe, continuing as a narrow band across dorso-posterior corner of anepisternum and vertically over anepimeron and onto sternopleuron as a narrow spot.

Remainder of pleura and sternum black. Scutellum blackish brown, with 1 pair of apical setae. Postscutellum and mediotergite black with a broad fulvous medial stripe. Haltere dark fulvous.

Legs with coxae black, fore femur dark fulvous to red-brown, palest in apical half; mid femur red-brown, fulvous over basal third; hind femur dark red-brown, paler apically and fulvous over basal fifth; tibiae and tarsi dark red-brown; mid tibia with 1 long and 2 short apical spines.

Wing (Fig. 16) with brown costal band expanding broadly across R-M crossvein and apex of cell dm into cell m almost to apex of vein Cu₁ but not extending into cell cu₁, leaving that cell almost entirely hyaline except for a narrow brown band at base that connects with the costal band over BM-Cu crossvein. Costal cells subhyaline. R-M crossvein separated from DM-Cu crossvein by about twice its own length. Cell bcu apically acute but not extended into a lobe.

Abdomen (Fig. 12) broadly petiolate; tergites I+II large, with yellow medial band as broad as basal black band and separated from hind margin by about its own length; tergites III-VI black except tergite V weakly fulvous posteromedially and tergite VI broadly fulvous. Oviscape (Fig. 11) fulvous, narrowing and tubular posteriorly, about as long as tergites III-V; length 1.7 mm.

Male unknown.

Etymology. Named after the type locality, Mimika River.

Distribution. Known only from SW Papua Province, Indonesia.

Comments. *Diplochorda mimika* sp. n. most closely resembles *D. trilineata* de Meijere and its allies (couplets 9-11 in the following key), particularly in the thoracic, leg and abdominal markings; it differs in the more extensive wing pattern and black face. The hyaline wing cell cu₁ is shared with *D. unistriata* Malloch but that species additionally has the medial scutal vitta not or at most indistinctly interrupted near the suture and a broader yellow band on abdominal tergites I+II. It differs from *D. macalpinei*, which also has an extensive wing pattern and hyaline cell cu₁, in characters noted under that species. A relationship with the *trilineata* series suggests that males will have the genital processes represented by low ridges although a relationship with *D. myrmex*, which also has an extensive wing pattern, cannot be ruled out.

New locality records

Diplochorda aneura Malloch, 1939

PAPUA NEW GUINEA: Wutung, West Sepik Province, 12.xi.1985, J.W. Ismay (1 teneral ♂, in AM); Stephansport, Astrolabe Bay, Madang Province, 1894, Kunzmann (3 ♂♂, 2 ♀♀, in NHMUK). Described from Wewak, East Sepik Province.

Diplochorda brevicornis (Saunders, 1861)

INDONESIA: Fak Fak, [Onin Peninsula], West Papua Province, A.E Pratt per Janson (1 ♂, in NHMUK). Described from Manokwari (= Dorey), West Papua Province.

Diplochorda concisa (Walker, 1861)

INDONESIA: Fak Fak, [Onin Peninsula], West Papua Province, A.E. Pratt per Janson (1 ♂, in NHMUK). PAPUA NEW GUINEA: Aroana Estate, Aroa R., Central Province, 29-30.xi.1963, D.K. McAlpine (1 ♂, 1 ♀, in AM); Buri & Savipi nr Sasambata and Ongaho, all Popondetta subdistrict, Northern Province, 28.x.-1.xi.1963, D.K. McAlpine (2 ♂♂, 3 ♀♀, in AM); Ilimo nr Kokoda, Northern Province, 31.x.1963, D.K. McAlpine (1 ♀, in AM); Lae, Morobe Province, 6-7.ii.1967, G.B. Monteith (1 ♂, in QM). Hardy and Foote (1989) treated *D. concisa* and *D. turgida* (Walker, 1865) as separate species, regarding '*D. concisa*' of Malloch (1939) (1 ♀ det *concisa* from Mt Lamington examined, in AM) as a misidentification of *D. turgida*. Re-examination of their lectotypes (*concisa* ♀ [NHMUK010579890] and *turgida* ♂ [NHMUK010579891], in NHMUK) and a paralectotype ♂ of *D. turgida* (in QM), plus the occurrence of both taxa at Manokwari in West Papua Province, supports their synonymy. Described from Manokwari (*concisa*: labelled 'Dor. 68.4') and Salawati Island (*turgida*: labelled 'S. 68.4') and recorded from Ramoi (near Sorong) by Osten Sacken (1881), all in West Papua Province. A further synonym, *D. longistigma* (Perkins, 1939), was described from a female from Kokoda, Northern Province, Papua New Guinea.

Diplochorda minor Malloch, 1939

PAPUA NEW GUINEA: Gabensis, ca 20 mi SE [recte W] of Lae, Morobe Province, ca 100 m, 30.vi.1970, P.H. Colman (1 ♀, in AM); Stony Logging Area, nr Bulolo, Morobe Province, 28.iii.1979, herb layer lowland rainforest, H. Roberts, det. D.E. Hardy (1 ♂, in AM); Musgrave R. nr Port Moresby, Central Province, 950 m, 8.x.1963, D.K. McAlpine (1 ♀, in AM). Described from Bulolo, Morobe Province.

Diplochorda myrmex Osten Sacken, 1881

PAPUA NEW GUINEA: Aroana Estate, Aroa R., Central Province, 29.xi.1963 & 6.xii.1963, D.K. McAlpine (1 ♂, 1 ♀, in AM); 5 km NW of Brown River bridge, Central Province, forest, 6.ix.1984, J.W. Ismay (1 ♂, in AM). The newly recorded males have broad genal processes and a strongly arched costa. The Brown River bridge female recorded by Hancock (2016) (in NHMUK) is illustrated in Figs 17-18 but the abdomen is distinctly broader in other specimens. Described from Binaturi River (= Katau), Western Province.



Figs 17-18. *Diplochorda myrmex* Osten Sacken, female from 5 km NW Brown River bridge: (17) dorsal view; (18) wing. Photos © Natural History Museum, London.

Diplochorda ophion Osten Sacken, 1881

INDONESIA: Fak Fak, [Onin Peninsula], West Papua Province, A.E. Pratt per Janson (1 ♂, in NHMUK). PAPUA NEW GUINEA: Bubia, nr Lae,

Morobe Province, 27.xii.1963, D.K. McAlpine (1 ♂, in AM); 5 km S of Sirinumu Dam, Central Province, 800 m, forest, 15.vi.1986, J.W. Ismay (1 ♂, in AM). The newly recorded males have the genal processes represented by low ridges. The abdomen is distinctly yellow medially in the holotype and heavily infuscated in the Papua New Guinea specimens (with only a yellow tint evident) but the Fak Fak specimen (Figs 19-20) is intermediate, suggesting that all are conspecific. This species, described by Osten Sacken (1881) from Hatam, near Manokwari in West Papua Province, had not been illustrated previously. It is newly recorded from Papua New Guinea.



Figs 19-20. *Diplochorda ophion* Osten Sacken, male from Fak Fak: (19) dorsal view; (20) wing. Photos © Natural History Museum, London.

Diplochorda trilineata de Meijere, 1915

INDONESIA: Sewau Res., Serui, [Japen Island], Papua Province, 12.iii.1958, R.T. Simon Thomas (1 teneral ♂, in AM). PAPUA NEW GUINEA: Aitape, West Sepik Province, F.H. Taylor (1 ♀, in AM); Bainyik, Imbia & Kuminibur, near Maprik, East Sepik Province, 17-22.xii.1963, D.K. McAlpine (3 ♂♂, 2 ♀♀, in AM); Stephansport, Astrolabe Bay, Madang Province, 1894, Kunzmann (1 ♀, in NHMUK). Specimens from Wewak and Maprik recorded as '*D. myrmex*' by Malloch (1939) (3 ♂♂, in AM) are confirmed as misidentifications of *D. trilineata*. Described from Jayapura district, NE Papua Province and recorded from Madang by Hancock and Drew (2003).

Diplochorda unistriata Malloch, 1939

PAPUA NEW GUINEA: Upper Manki Logging Area, nr Bulolo, Morobe Province, 5000', xii.1972-iii.1973, F.R. Wylie & P. Shanahan, sticky trap (13 ♂♂, 13 ♀♀, in AM); Stony Logging Area, near Bulolo, Morobe Province, 20.vi.1979, under *Musa* leaf, H. Roberts (1 ♂, 1 ♀, in AM). Described from Mondo, Central Province and recorded from Arau nr Kainauto, Eastern Highlands Province by Hancock and Drew (2003).

Revised key to *Diplochorda* species

- 1 Wing with apex of costal band extending broadly across R-M crossvein and apex of cell dm and into cell m almost to vein Cu₁ 2
- Wing with apex of costal band not extending broadly across apex of cell dm into cell m almost to vein Cu₁ 4
- 2 Wing with hyaline discal area hatchet-shaped, subquadrate in centre of wing, extending along its length anteriorly across vein R₄₊₅ to vein R₂₊₃; cell cu₁ almost entirely brown; male with broad genal processes [Papua New Guinea (Western and Central Provinces); *Nesadrama petiolata* Hardy, 1974 is a synonym] *D. myrmex* Osten Sacken, 1881
- Wing with hyaline discal area elongate; cell cu₁ hyaline except extreme base; male unknown or with genal processes represented by low ridges 3
- 3 Face yellow with a pair of oblique black spots; wing cell r₄₊₅ with a hyaline indentation anterobasally; legs largely fulvous [Papua New Guinea (East Sepik Province)] *D. macalpinei* **sp. n.**
- Face entirely black; wing cell r₄₊₅ entirely brown; legs largely fuscous [eastern Indonesia (SW Papua Province)] *D. mimika* **sp. n.**
- 4 Thorax with scutum anterior to suture largely or entirely black, without distinct longitudinal yellow vittae; male with broad genal processes 5
- Thorax with scutum anterior to suture yellow with 3 longitudinal black vittae; male with genal processes represented by low ridges 8

- 5 Wing with costal band crossing R-M crossvein and filling most of cell r_{4+5} [northern Papua New Guinea (West Sepik, East Sepik and Madang Provinces); wing and head illustrated by Malloch (1939)] *D. aneura* Malloch, 1939
- Wing with costal band not crossing R-M crossvein and filling none or only part, faintly, of cell r_{4+5} 6
- 6 Scutum posterior to suture largely yellow with a medial longitudinal black vitta [Australia (Iron Range, northern Qld); records from Papua New Guinea are misidentifications; illustrated by Permkam and Hancock (1995)] *D. australis* Permkam & Hancock, 1995
- Scutum posterior to suture largely black with only narrow posterolateral yellow patches 7
- 7 Wing vein Cu_1 infuscated and cell cu_1 with a brown band in anterior half [eastern Indonesia (West Papua Province); illustrated by Saunders (1861: male only)] *D. brevicornis* (Saunders, 1861)
- Wing vein Cu_1 not infuscated and cell cu_1 with at most a very faint infuscation in anterior half [Papua New Guinea (Morobe Province)] *D. buloloae* **sp. n.**
- 8 Legs yellow with faint vestiges of a brownish ring on femora; abdomen medially broadly yellow with a varying density of infuscation and yellow band on tergite 1+2 large and reaching or almost reaching hind margin of segment; wing cell cu_1 mostly brown [eastern Indonesia (West Papua Province) and Papua New Guinea (Central and Morobe Provinces)] *D. ophion* Osten Sacken, 1881
- Legs with mid and hind femora broadly brown to black medially; abdomen mostly brown to black, often paler posteriorly and with yellow band on tergite 1+2 normally small and separated from hind margin by more than half its length, if larger then wing cell cu_1 hyaline 9
- 9 Wing cell cu_1 hyaline; face yellow; abdomen with yellow band on tergite 1+2 large, separated from hind margin by less than half its length [Papua New Guinea (Central, Morobe and Eastern Highlands Provinces above 1200 m)] *D. unistriata* Malloch, 1939
- Wing cell cu_1 brown at least anteriorly; face with a pair of black spots or band near epistome; abdomen with yellow band on tergite 1+2 small, separated from hind margin by about its own length or more 10
- 10 Wing with costal band crossing R-M crossvein and filling all or most of cell r_{4+5} [eastern Indonesia (northern Papua Province) and northern Papua New Guinea (West Sepik, East Sepik and Madang Provinces); ‘*D. myrmex*’ of Malloch (1939) is a misidentification; wings illustrated by Malloch (1939)] *D. trilineata* de Meijere, 1915

- Wing with costal band not crossing R-M crossvein and filling none or only part, faintly, of cell r_{4+5} 11
- 11 Wing with costal band not crossing vein R_{4+5} into cell r_{4+5} or at most very faintly; brown band along vein Cu_1 in cell cu_1 not extending into cell dm in female and only very weakly so in male; dark band on lower part of face in male narrow and not reaching epistome [Papua New Guinea (Central and Morobe Provinces); wing illustrated by Malloch (1939)] *D. minor* Malloch, 1939
- Wing with costal band usually crossing vein R_{4+5} into apical half to two-thirds of cell r_{4+5} in its anterior half and often extending weakly as a narrow patch almost to apex of vein M; brown band along vein Cu_1 in cell cu_1 extending narrowly into cell dm in female and broadly in male; dark band on lower part of face in male broad and reaching epistome [eastern Indonesia (West Papua Province) and Papua New Guinea (Central, Northern and Morobe Provinces); *Dacus turgidus* Walker, 1865 and *Nesadrama longistigma* Perkins, 1939 are regarded as synonyms; male illustrated by Saunders (1861, as '*Elaphomyia brevicornis* female', a misidentification) and female wing illustrated by Perkins (1939, as '*N. longistigma*')] *D. concisa* (Walker, 1861)

Discussion

The twelve known species fall into two groups: the *brevicornis* group of five species has the male genital processes broad and well developed, while the *concisa* group of seven species [provisionally including *D. mimika*] has these processes reduced to a narrow ridge (apomorphy?). Broad genital processes are also present in the related genus *Ortaloptera* Edwards and are thus considered to be the plesiomorphic state within *Diplochorda*.

Within the *brevicornis* group, *D. myrmex* stands apart in having a shortened cell dm and extensively dark wing yet retains the typical scutal pattern of broad black lateral and medial vittae, the medial interrupted near the suture. In the remaining species the scutum is extensively black, especially in the anterior portion. The dark costal band is broad in *D. aneura* and narrow in *D. brevicornis*, *D. buloloae* and *D. australis*, these latter three species apparently forming a related trio. All five species are allopatric.

Within the *concisa* group two species stand apart: *D. macalpinei* and *D. ophion* have distinctly paler legs and scutum, the black medial vitta of the scutum being narrow instead of the typically broad vitta of the remaining species. Although *D. mimika* has a wing pattern similar to that of *D. macalpinei* other characters, particularly the scutal markings and more distinctly petiolate abdomen, suggest a closer relationship with the remaining species, which appear to form a close-knit group: *D. trilineata* is separated by its broad costal band; *D. unistriata* has a hyaline cell cu_1 ; *D. minor* and *D. concisa* are only weakly differentiated and possibly conspecific.

Distributions are imperfectly known for most species but some inferences can be made. Two species, *D. concisa* and *D. ophion*, are known from both West Papua Province and SE Papua New Guinea but their distributions are likely to be widespread rather than disjunct, the intermediate areas being poorly collected. Three species, *D. aneura*, *D. trilineata* and *D. macalpinei*, are known only from lowland forests north of the Central Range, covering the northern part of Indonesian Papua Province (including Japen Island) and the Papua New Guinean Provinces of West Sepik, East Sepik and Madang; no other species have been recorded from this area.

The remaining species have more restricted distributions in the western, southern and eastern parts of mainland New Guinea or (*D. australis*) the Iron Range area of Cape York Peninsula, Australia. The related *D. brevicornis* and *D. buloloae* are known only from West Papua and Morobe Provinces, respectively; *D. mimika* is known only from SW Papua Province and *D. myrmex* only from southern Papua New Guinea; *D. unistriata* is known only from highland areas in Central, Eastern Highlands and Morobe Provinces; *D. minor* is known only from Central and Morobe Provinces.

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NEW DISTRIBUTION AND FOODPLANT OBSERVATIONS FOR BUTTERFLIES (LEPIDOPTERA) IN NEW SOUTH WALES

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Abstract

New distribution records are provided for 14 species of butterflies from the western slopes, plains and coast of New South Wales. In addition, host plant records are provided for several species and *Hypochrysops cyane* (Waterhouse & Lyell) is newly recorded from *Cupaniopsis anacardiodes* (Sapindaceae).

Observations

HESPERIIDAE

Herimosa albovenata weemala (L.E. Couchman, 1954) (Figs 1-8)

The authors recently extended the range of this subspecies from Gunnedah south-west to 5 km west of Dubbo (Moore and Petrie 2014). Subsequent collecting in 2014 and 2015 has extended this further east to 17 km north-west of Mudgee (-32.2543, 149.5343) at 485 m.

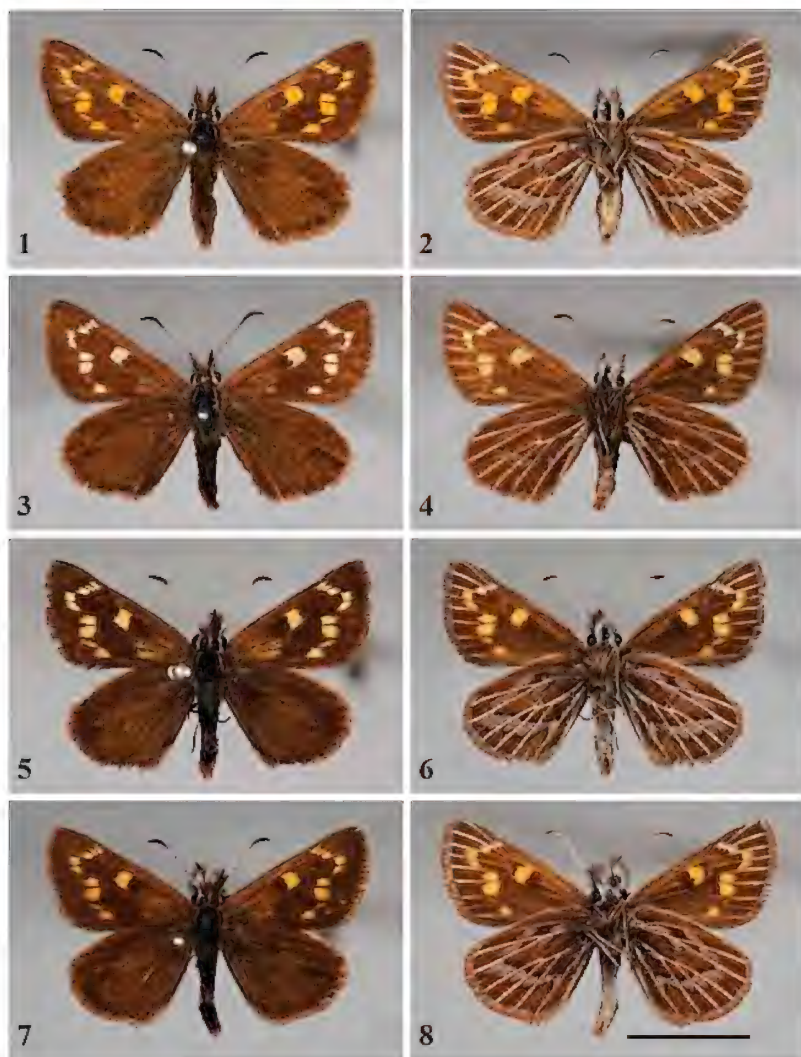
Adults of both sexes were active from 0900 to 1600 hrs on sunny days in early to mid-September, typically on bare patches of ground in semi-cleared box woodland and fully open cleared paddocks. They favoured a highly disturbed roadside area, where significant soil disturbance by bulldozers had created bare areas of shale and soil interspersed with grasses. Adults of both sexes occupied these small areas and defended them from other individuals. Adults flew as early as 0900 hrs, with the air temperature at only 8°C, by sunning themselves on warm areas of bare earth.

The species was not evident in these localities on another visit in mid-October, where individuals of *Taractrocera papyria* (Boisduval, 1832) and *Toxidie parvulus* (Plötz, 1884) occupied the same lekking areas. There is an abundance of *Austrostipa glabra* (Poaceae) at this locality and, on 11 September 2016, a pupa was found in a shelter on *Austrostipa* (Fig. 9). A male emerged on 16 September 2016, confirming the host plant at this location.

Toxidie parvulus (Plötz, 1884)

An adult male was collected on 11 October 2014 in mixed open box woodland and *Callitris* pine forest, 24 km east of Mudgee (-32.7266, 149.7548) at 560 m.

A second adult male was collected on 12 October 2014, 17 km north-west of Mudgee (-32.2543, 149.5343) at 485 m. These are the first records of *Toxidie parvulus* from west of the Great Dividing Range (Dunn and Dunn 1991).



Figs 1-8. *Herimosa albovenata weemala* (Couchman, 1954) from 17 km NW of Mudgee, NSW, September 2015: (1, 3) upperside and (2, 4) underside of two females; (5, 7) upperside and (6, 8) underside of two males. Scale line on Fig. 8 equals 10 mm and applies to all. Specimens in EP collection.



Fig. 9. Pupa of *Herimosa albovenata weemala* on an *Austrostipa* plant from 17 km NW of Mudgee, NSW, in September 2016.

Trapezites lutea (Tepper, 1882)

A final instar larva was collected in mid-September from a small-leaved blue *Lomandra* sp. (Xanthorrhoeaceae), in ironbark woodland 1 km north-east of Dubbo (-32.2258, 148.6601) at 323 m. It was reared in Sydney on this plant and a female emerged on 15 October 2014. Pupal duration in October at Sydney was 21 days.

An adult male was collected on 5 October 2008, 50 km south-east of Mudgee (-32.9307, 149.8524), in open paddock grassland at 600 m with three associated *Lomandra* spp present.

A second adult male was collected on 11 October 2014 in mixed open box woodland and *Callitris* pine forest, 24 km east of Mudgee (-32.7266, 149.7548) at 560 m, flying in association with *Toxidia parvulus* and *Taractrocera papyria*.

A third adult male was collected on 11 September 2013, east of Gunnedah near the turnoff to Lake Keepit (-30.9574, 150.5297) at 313 m.

These distribution records confirm that this species is widespread in the central west of New South Wales.

Hesperilla idothea (Miskin, 1889)

A female emerged on 28 October 2014 from a pupa collected on 25 October 2014 on *Gahnia melanocarpa* (Cyperaceae), at Hungry Head near Urunga (-30.5214, 153.0274). This is an unusual north-coastal location for this species.

Hesperilla donnysa donnysa (Hewitson, 1868)

Several early instar larvae were collected on 12 October 2014 from *Gahnia radula* (Cyperaceae), near Minore Road west of Dubbo (-32.2544, 148.5301) at 302 m. One larva survived to pupate on 20 February 2015 and a female emerged on 9 March 2015. Braby (2000) listed the western extent of this species as Cowra; therefore this is an additional western record for this species. A male was collected on 16 March 2013 flying around *Gahnia* sp. near Maria River Road, Riverside (north of Port Macquarie: -31.3823, 152.8664), thus confirming older records of this species at this location (Dunn and Dunn 1991).

Hesperilla hopsoni (Waterhouse, 1927)

This species was commonly found as adults (emerging 9-19 December 2012) and, prior to that, as immature stages (4-5 December 2012) on *Gahnia siberiana* (Cyperaceae), near Grass Tree Picnic area in Werrikimbe National Park (-31.1503, 152.3581). This record provides a further intermediate location between populations at Ebor and Barrington Tops.

LYCAENIDAE

Deudorix diovis (Hewitson, 1863)

Braby (2000) recorded this species as reaching Gosford with two odd records farther south. Over the past two years *Deudorix diovis* has been sighted regularly and captured in the Sydney suburbs of Chatswood and Marrickville. Adults appear from November to April with a peak flight period in late March.

At Marrickville the butterfly is now breeding on *Harpullia pendula* and *Cupaniopsis anacardioides* (both Sapindaceae), which are common footpath verge trees in this Sydney suburb. At both localities adult males and females fly around favoured trees of both species, in association with *Erysichton lineata* (Murray, 1874) and *Prosotas felderi* (Murray, 1874).

Pupae can be found at the bases of trees provided plenty of leaf mulch is present and it is these trees that adults frequent. The species appears not as abundant in Sydney as in localities such as Coolum Beach on the Sunshine Coast where, at times, up to 50 pupae can be found in leaf litter at the base of individual host trees and adults are abundant around these trees. EP has lived and collected in Sydney since 1970 and *D. diovis* did not occur until the proliferation of suitable host plants in suburban street lines in the last decade. The butterfly now appears to be permanently established in Sydney.

Hypocrysops cyane (Waterhouse & Lyell, 1914)

Cupaniopsis anacardiodes (Sapindaceae) is recorded as a new larval host plant for this species at Nelson Bay, New South Wales. Adults were collected as larvae on 17 January 2001 and reared to adults in Sydney. Pupal duration in February was 14–18 days.

Ogyris amaryllis amaryllis (Hewitson, 1862)

Specimens were collected and reared from pupae 6 km west of Mudgee (-32.7266, 149.7548) at 495 m in October and November 2014.

These specimens are highly variable in the colour and extent of the blue central areas. Some are identical with coastal specimens from Port Stephens and Pokolbin, while others have the blue areas reduced and approach *Ogyris amaryllis amata* (Waterhouse, 1934) from Tuggeranong, ACT in appearance.

Philiris innotatus innotatus (Miskin, 1874).

On 27 February 2015, around the carpark at Hungry Head near Urunga (-30.5213, 153.0274), many mature larvae and pupae were found on small sandpaper figs (*Ficus* sp: Moraceae) and adults emerged between 8 and 13 March 2015. Additionally, on 14 April 2016, several male and female adults were found at the Orara River rest area near Ramornie (-29.6517, 152.7994), confirming a 1966 record by Peters (1969). Further, on 16 April 2015 a solitary, worn adult female was collected on the North Shore of Port Macquarie (-31.3885, 152.9206), confirming the previous southern record for this species of two male specimens collected in 1935 by T.R. Raine and M.F. Day (Peters 1969).

Candalides absimilis absimilis (C.Felder 1862).

A single male was recorded from a hilltop west of Gunnedah (11 February 2011: -30.9733, 150.1454). Braby (2009) suggested that '*C. absimilis absimilis* ... is otherwise known only from the coastal areas east of the Great Escarpment.' The present record might be an introduction through nursery stock of *Brachychiton*, but may also show establishment of the species at this location. Braby (2009) also suggested that hill-topping was an unusual activity for *Candalides absimilis absimilis*.

NYMPHALIDAE

Euploea tulliolus tulliolus (Fabricius, 1793).

An adult female in good condition was collected on 16 April 2015 on the North Shore of Port Macquarie, confirming a previous southern sight record for this species in Port Macquarie (Moore and Ginn 2009)

Oreixenica latialis (Waterhouse and Lyell 1914)

E.D. Edwards (in Braby 2000) recorded the northernmost population at the Boyd R. near Kanangra Walls, New South Wales. On 26 March 2015 adults were abundant 11 km north of Boyd R (-33.8867, 150.0460) at 1235 m,

establishing a new northern record for this species. Specimens are markedly yellower than the closest known population at Ginini Flats, ACT, where the orange markings are much richer in colour. The specimens from this new locality show a much closer affinity with Prussian Creek and Sawpit Creek populations near Mt Kosciuszko than with the Ginini Flats specimens.

Oreixenica lathioniella herceus (Waterhouse & Lyell, 1914)

An interesting isolated population was discovered at Mt Gibraltar near Bowral (-34.4674, 150.4286), in April 2014 at above 900 m. Specimens at this location are consistently larger and brighter than those from both Ebor and the Blue Mountains. Adults flew very late in the season, with the first not appearing until the end of the first week of April and peaking by 15 April. This locality is abundant in satyrids earlier in the season, with *Geitoneura acantha* (Donovan, 1804), *Geitoneura klugii* (Guérin-Ménéville, 1830), *Heteronympha merope* (Fabricius, 1774), *Heteronympha penelope* Waterhouse, 1937, *Heteronympha paradelpha* Lower, 1893, *Heteronympha banksii* (Leach, 1814), *Tisiphone abeona* (Donovan, 1803) and *Argynnina cyrila* Waterhouse & Lyell, 1914 all being present and common, but by the time *Oreixenica lathioniella* (Westwood, 1851) is on the wing, with the exception of a few worn *H. banksii* and *H. merope*, all other satyrids there have completed their flight season.

Acknowledgement

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**FIRST RECORD OF *TAENARIS CATOPS TURDULA*
FRUHSTORFER, 1914 (LEPIDOPTERA: NYMPHALIDAE:
AMATHUSIINAE) FROM DAUAN ISLAND, TORRES STRAIT,
QUEENSLAND**

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Abstract

Taenaris catops turdula Fruhstorfer, 1914 is recorded from Dauan Island, Torres Strait, Queensland. The single male specimen is the first record of this species from Dauan Island and the first male recorded from Australia. It also represents the fourth recorded Australian specimen with all specimens known only from Torres Strait, where the species is recorded from Erub (Darnley) (collected in 1910) and Saibai Islands (collected in 1996). Field observations of the butterfly are recorded and wing pattern elements that distinguish *T. c. turdula* from other *Taenaris* spp known from Torres Strait are presented.

Introduction

The genus *Taenaris* Hübner, 1819 contains approximately 25 species ranging from Malaysia through the Moluccas, New Guinea and several islands of the Torres Strait to the Solomon Islands (Parsons 1998, Braby 2000, Tennent 2002, Lambkin 2010). In Australia, the genus is represented by *T. artemis jamesi* Butler, 1877, *T. catops turdula* Fruhstorfer, 1914 and *T. myops kirschi* Staudinger, 1887 (Waterhouse and Lyell 1914, Braby 2000, Lambkin 2010, Braby 2016), predominantly from Torres Strait, with only *T. a. jamesi* recorded from mainland Australia (Johnson and Johnson 1991). Within Australia, *T. c. turdula* has been infrequently collected from Torres Strait and has been known only from three female specimens: two from Darnley Island, 13.v.1910 HE (AM) and 18.v.1910 HE (MV), and one from Saibai Island, 1.iii.1996, TAL (TLIKC) (Waterhouse and Lyell 1914, Braby 2000, Lambkin 2010). No males have been recorded previously from Australia.

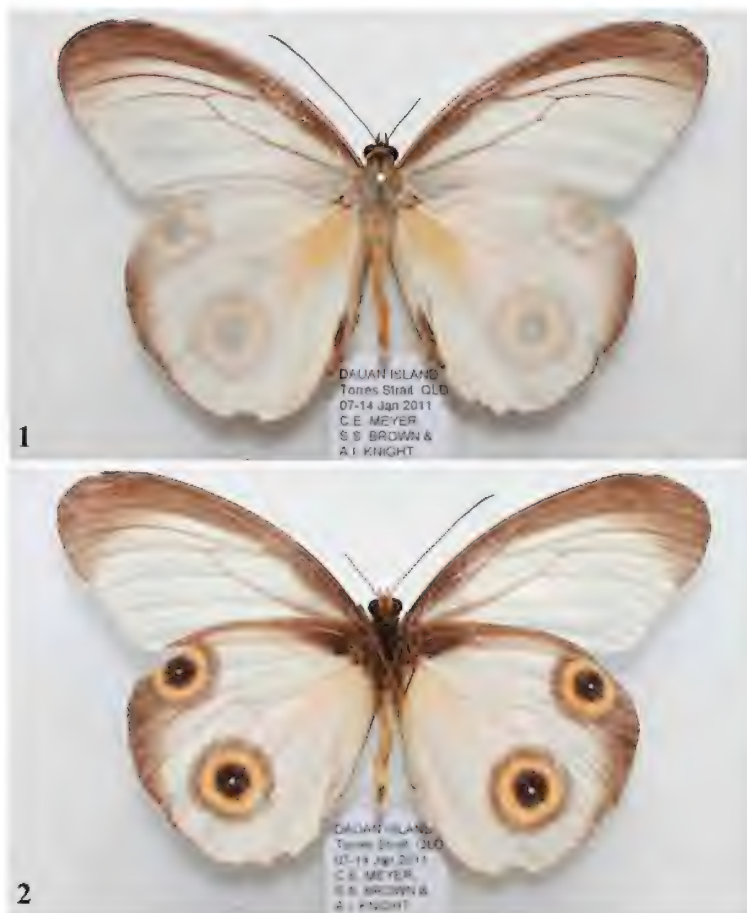
Abbreviations for specimen repositories: AM – Australian Museum, Sydney; CEMC – C.E. Meyer Collection, Brisbane; MV – Museum of Victoria, Melbourne; TLIKC – Joint collection of T.A. Lambkin and A.I. Knight, Brisbane.

Abbreviations for collectors: AIK – A.I. Knight, CEM – C.E. Meyer, HE – Hermann Elgner, SSB – S.S. Brown, TAL – T.A. Lambkin.

Field observations and discussion

On 14 January 2011, a male *T. c. turdula* (Figs 1-2) was collected by CEM (CEMC) from under mango trees (*Mangifera indica* L., Anacardiaceae) at 0800 h. A female *T. a. jamesi* was also collected from the same location shortly afterwards at 0805 h. Both butterflies were settled on low foliage in

the shaded understory below the mango trees and were only observed when they took flight following disturbance. Many rotting and fermenting mangoes were littered on the ground under the trees.



Figs 1-2. *Taenaris catops turdula*, male from Dauan Island, 07-14.i.2011, CEM, SSB & AIK [forewing 42 mm, wingspan 83 mm]: (1) upperside; (2) underside.

Males of *T. catops* (Westwood, 1851) can be distinguished from males of the other two species occurring in Australia by their squatter forewings, prominent dark scaling along the radial, medial and cubital veins on the forewing upperside and the forewing inner margin always lacking dark scaling (Parsons 1998). *Taenaris artemis* (Snellen van Vollenhoven, 1860)

(Figs 3-4) and *T. myops* (C. & R. Felder, 1860) lack the prominent dark scaling along the veins present in the upper part of the forewing of *T. catops* males. In addition, the other two species have broad but variable dark forewing inner margins (Parsons 1998). Waterhouse and Lyell (1914) noted that the tornal eye-spots on the underside of the hind wing of *T. catops* are more proximally situated than in *T. artemis*. Thus, the specimen from Dauan Island is placed within *T. c. turdula* and represents the first male record for Australia.



Figs 3-4. *Taenaris artemis jamesi*, male from Murray Island, 06-10.iv.2001, CEM & SSB [forewing 48 mm, wingspan 93 mm]: (3) upperside; (4) underside.

Parsons (1984) recorded *Cordyline terminalis* (L.) Kunth (Liliaceae) and *Phaius tancarvilleae* (Banks ex l'Her.) Blume (Orchidaceae) as host plants in Papua New Guinea. In addition, D'Abrera (1978) recorded *Musa* sp. (Musaceae), *Areca catechu* L. and *Caryota rumphiana* Mart. (both Arecaceae) as host plants. Species belonging to Arecaceae, Musaceae and Orchidaceae are recorded from Dauan Island (Torres Strait Regional Authority 2013).

Further collecting of *Taenaris* spp on the northern and eastern Torres Strait islands could assist in determining the residency status of *T. c. turdula* in Torres Strait.

Acknowledgements

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A NEW ANT INQUILINE FLOWER FLY (DIPTERA: SYRPHIDAE: PIPIZINAE) FROM AUSTRALIA

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Abstract

Trichopsomyia formiciphila sp. n., a new ant inquiline flower fly, is described from eastern Australia. It has been reared in association with weaver ants of the genus *Polyrhachis* (*Cyrtomyrma*) Forel, in the nests of which its larvae are probably brood predators.

Introduction

Flower flies are abundant, conspicuous and varied. The adults are pollinators and the habits of the immatures are diverse, ranging from larval predators of various homopterous pests to filter-feeding rat-tailed maggots, with some specialised predators of ant brood (Rotheray and Gilbert 2011). More than 6200 species have been described (Thompson 2013). While our knowledge of the flower fly fauna of Europe is rich, very little is known of the Australian fauna. The last significant work on this fauna was completed in the 1920s and 30s (Ferguson 1926a, b, Hardy 1933), with a few revisionary keys published since (Riek 1954, Paramonov 1955a, b, 1957a, b, Thompson 1968, Wright and Skevington 2013, Mengual and Thompson 2015).

The association of flower flies with ants is mainly limited to species of the subfamily Microdontinae, all of which are inquilines as larvae. Beyond these and the species herein described, very few other species are known to be ant inquilines: some species of *Chrysotoxum* Meigen (Rotheray 1993: 70) and a species of *Platycheirus* Lepeletier & Serville from New Zealand (Thompson 1972). The first published record of the relationship between *Polyrhachis* Fr. Smith ants and *Trichopsomyia* Williston was made by Hölldobler and Wilson (1990).

Materials and methods

The terminology used follows Thompson (1999), which was derived originally from the *Manual of Nearctic Diptera* (McAlpine 1981). This is congruent with the terminology presented by Cumming and Wood (2009) except some terms used for the male genitalia that follow the latter.

For details concerning the collection and processing of the host ant nests in Townsville, together with the isolation and recording of their arthropod associates, including the syrphid material from this source contributing to this report, see Downes (2015).

Abbreviations used here include: AM – Australian Museum, Sydney, Australia; ANIC – Australian National Insect Collection, Canberra, Australia; BMNH – Natural History Museum (formerly British Museum (Natural History)), London, United Kingdom; CNC – Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Canada; JSS – Jeff Skevington specimen; QM – Queensland Museum, Brisbane, Australia; QMT – QM_REG._NO._T (Queensland Museum registration numbers appear on labels in this format, shortened to QMT throughout the text); USNM – National Museum of Natural History (formerly United States National Museum), Washington DC, USA.

DNA extraction, COI amplification and sequencing followed the methods outlined in Skevington and Thompson (2012). GenBank numbers are provided in the material examined list after the relevant specimens and begin with the letters KX (e.g. KX586304).

Systematics and biology

Trichopsomyia Williston

Trichopsomyia Williston 1888: 259. Type species: *Trichopsomyia polita* Williston by subsequent designation of Hull (1949: 330).

Diagnosis: A flower fly genus of the subfamily Pipizinae (face without an oral notch and pilose, eye pilose, facial groove (anterior tentorial) reduced to small circular pit; crossvein r-m basal, at basal 1/4 or less of cell DM) with anterior anepisternum pilose.

Triglyphus Loew and *Trichopsomyia* are the only pipizines with long erect pile on the anterior anepisternum. *Triglyphus* is easily separated from *Trichopsomyia*: as the name implies, it has only three well developed abdominal segments, whereas *Trichopsomyia* typically has four well developed segments.

While the genus was originally based on two species from Brazil, it is now known from all biotic regions except the Afrotropics (Palearctic (6), Nearctic (11), Neotropics (12), Oriental (2 undescribed), Australian (1)). This first species from the Australian region is described below.

Previously, the biology of only one *Trichopsomyia* species was known and that species is a larval predator of psyllids in their galls (Rotheray 1993: 90). The new species described below was found in ant nests where the flower fly larvae are probably brood predators.

Trichopsomyia formiciphila sp. n.

(Figs 1-3)

Trichopsomyia 88-20 Thompson (1988 manuscript).

Trichopsomyia sp. Hölldobler & Wilson 1990: 510, fig. 13-27 (larva, puparium and adult female) [biology].

Type material examined. Holotype ♂, AUSTRALIA (QUEENSLAND): Mission Beach, summit of Bicton Hill, 17°50'S 146°6'E, 24.xi.2014, J.H., A.M. and A.W. Skevington, CNC374747 (KX586304 QMT207068 (in QM)). *Paratypes:* 10 ♂♂, same data as holotype: CNC374740 (KX586306); CNC385009 (KX586307); CNC385010 (KX586305); CNC374739; CNC374741; CNC374742; CNC374743; CNC374744; CNC374745; CNC374746 (1 ♂ BMNH, 7 ♂♂ CNC, 2 ♂♂ USNM); 1 ♀, Bertie Creek (pump), 1 km Southeast Heathlands H.S., Cape York Peninsula, 11°46'S 142°35'E, 16.iii.1992, G. Daniels, M.A. Schneider, QMT220779 (in QM); 1 ♂, 1 ♀, Mount White, Coen, 13°58'S 143°11'E, 29.iv.1989, G. & A. Daniels, AMK404802; AMK404803 (in AM); 1 ♀, same data, JSS45806 (in AM); 1 ♀, Mount Cook, 15°30'S 145°16'E, 11.x.1980, D.H. Colless, USNM ENT249748 (in ANIC); 1 ♀, Shiptons Flat, 15°28'S 145°8'E, 17.x.1980, D.H. Colless, USNM ENT249746 (in ANIC); 2 ♂♂, 3 km NNW Palmer River Crossing, 16°4'S 144°47'E, 17.v.1989, G. & A. Daniels, AMK404804, JSS45805 (in AM); 1 ♂, same data except 19.v.1989, AMK404805 (in AM); 1 larva, Lake Eacham Visitor Centre, Atherton Tablelands, 17°17'9.60"S 145°37'44.40"E, 17.vi.2016, M Downes, *Polyrhachis monteithi* Kohout nest in groove of *Pandanus* leaf, larva was 8 cm inside the long thin nest (30x1x1 cm), nest was well occupied (39 alate queens, 172 males and 64 workers), but had only 8 larvae, no eggs or pupae, CNC583572 (KX946581: in CNC); 1 ♀, Baldwin Swamp Fauna Reserve, Bundaberg, 24°52'S 152°22'E, 3.iii.1978, H. Frauca, USNM ENT249747 (in ANIC); 1 ♀, Petrie, Brisbane, 27°16'S 152°59'E, *Polyrhachis* nest, 20.viii.1997, J. Warden, with puparial case (emerged 26.viii.1997), QMT222901 (KX586308: in QM); 4 ♂♂, 2 ♀♀, Windsor, Brisbane, 27°26'S 153°1'E, 22-23.ii.1997, C.J. Burwell, QMT222894 (KX586309); QMT222895; QMT222896; QMT222897; QMT222898; QMT222899 (in QM); 1 ♂, same data except 8.iii.1997, QMT222900 (in QM).

Other material examined. AUSTRALIA (NEW SOUTH WALES): 1 ♂, Lord Howe Island, 31°33'S 159°5'E, USNM ENT249889 (in ANIC). (QUEENSLAND): 1 puparium, Cranbrook, Townsville, 19°15'S 146°48'E, 10.vi.2013, M. Downes, CNC464849 (in CNC); 1 puparium, same data except 10.vii.2014, CNC464854 (in CNC); 3 puparia, same data except 19.i.2012, CNC464850; CNC464851; CNC464852 (in CNC); 1 puparium, same data except 29.ix.2009, CNC464855 (in CNC); 1 larva and puparium, same data except 8.i.2011, CNC464853 (in CNC).

Description. Length: body 7.8-10.0 mm; wing 6.5-8.0 mm.

Male. Head (Figs 1A-C) black; face shiny except white pollinose medial vitta, white pilose; gena narrow, black, black pilose, shiny on anterior 2/3, white pollinose posteriorly; frontal triangle shiny on ventral 2/3, black pollinose dorsally except narrowly white pollinose along eye margin laterad to antenna, black pilose on black pollinose area and narrowly dorsad to lunule, white pilose medially; lunule black; holoptic, continuity as long as vertical triangle; vertical triangle black, black pollinose and pilose; eye densely black pilose; occiput black, white pollinose and pilose on ventral 2/3, becoming shiny and black pilose dorsally; antenna orange on scape and pedicel, black pilose; basoflagellomere elongate, about 4 times as long as broad; ratio 1:1:4.

Thorax (Figs 1A-B) black; postpronotum brownish black, brown pilose; mesonotum shiny, white pilose anterior to transverse suture and broadly anterior to scutellum, black pilose medially; postalar callus brownish orange; scutellum shiny, black pilose medially, white pilose marginally; pleuron shiny, black pilose except anepisternum white pilose; plumula black; halter yellow; calypter with dorsal lobe black, ventral lobe white with black margin and fringe. Legs: black except pro- and metatarsi yellow and metatarsus yellow on basal 2/3 of basitarsomere, black pilose except pale yellowish-white pilose on pale areas; metatibia slightly swollen and arcuate.



Fig. 1. *Trichopsomyia formiciphila* sp. n., male: (A) dorsal habitus (CNC374747); (B) lateral habitus (CNC374745); (C) oblique frontal of head (CNC374745). Scale bars = 1 mm.

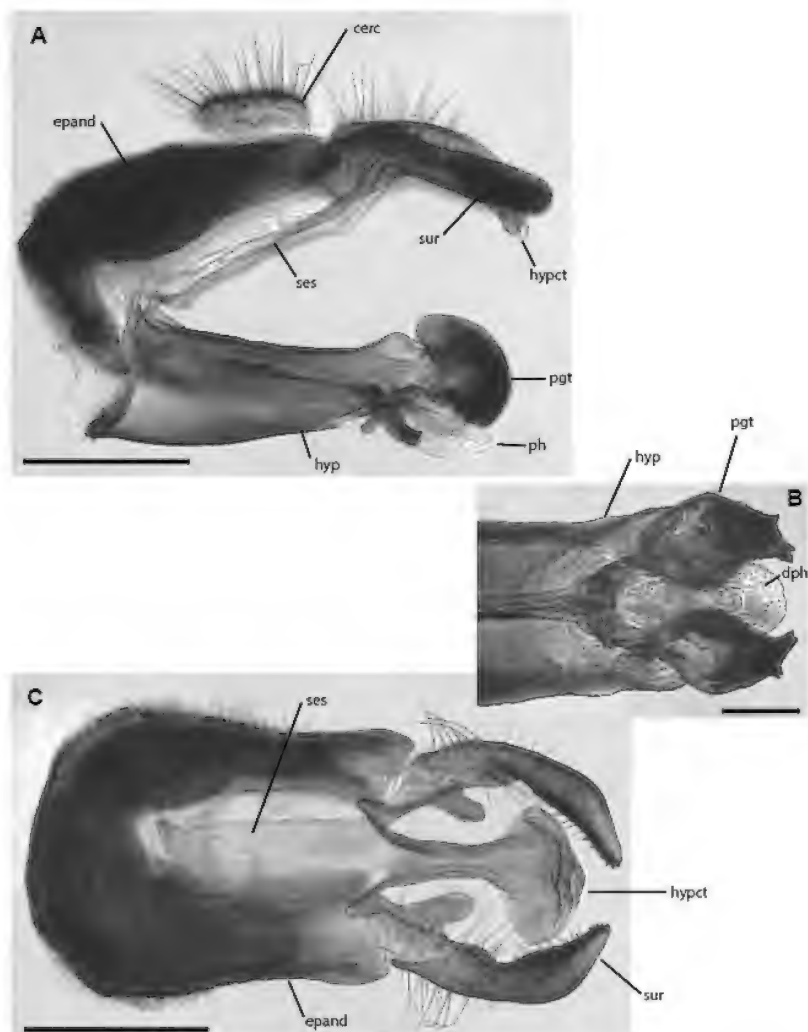


Fig. 2. *Trichopsomyia formiciphila* sp. n., male genitalia (CNC374745): (A) right lateral of terminalia, scale bar 0.3 mm; (B) ventral of phallus and associated structures, scale bar 0.1 mm; (C) ventral of surstyli and associated structures, scale bar 0.3 mm. Abbreviations: cerc – cercus; dph – distiphallus; epand – epandrium; hyp – hypandrium; hypct – hypoproct; pgt – postgonite; ph – phallus; ses – subepandrial sclerite; sur – surstylus.

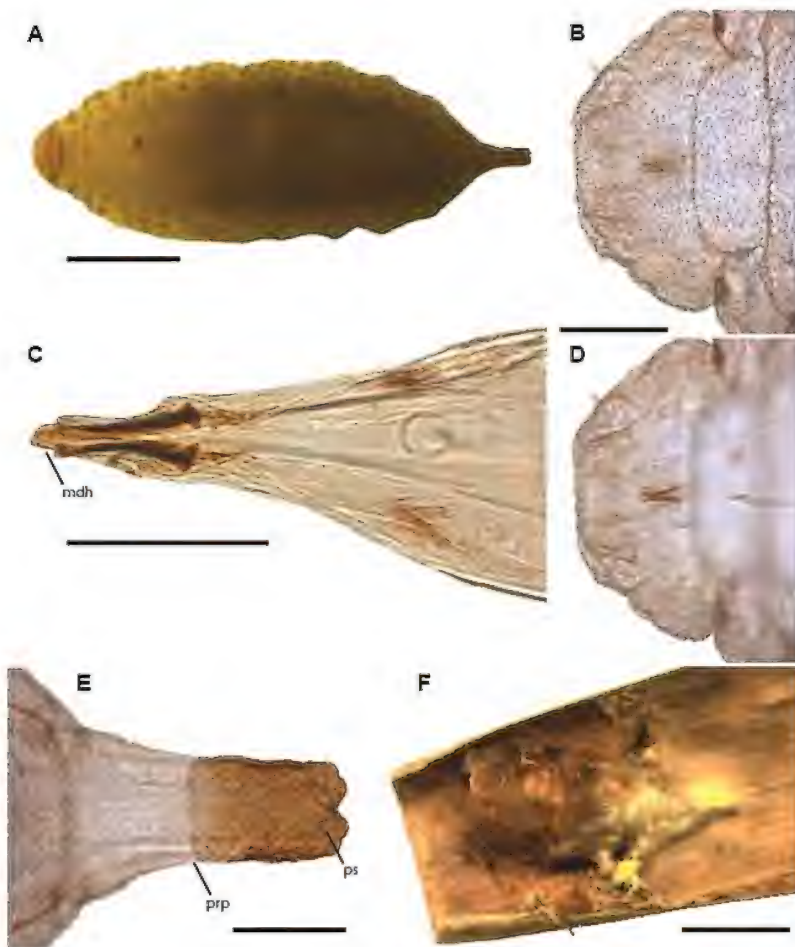


Fig. 3. *Trichopsomyia formiciphila* sp. n., larva and puparium: (A) dorsal view of live larva (CNC583572), scale bar 2.0 mm; (B) dorsal view of larval head (CNC583572), scale bar 0.5 mm; (C) ventral view of larval mouthparts (CNC583572), scale bar 0.2 mm; (D) ventral view of larval head (CNC583572), scale bar 0.5 mm; (E) dorsal view of posterior spiracles (CNC583572), scale bar 0.5 mm; (F) puparium *in situ* against the inner wall of a *Polyrhachis australis* nest; the remains of the nest wall (carton) can be seen along the inner lower edge; scale bar 4.0 mm. Abbreviations: mdh – mandibular hook; prp – posterior respiratory process; ps – posterior spiracle.

Wing diffuse brownish, microtrichose except bare as follows; basal 1/5 of costal cell, basal 1/3 of cell R, antero basal 2/3 of cell M, antero basal 1/5 of cell CuP [anal] and narrowly anterior to vein A2; alula microtrichose.

Abdomen (Fig. 1A) black; with two pair of large quadrate yellow maculae on 2nd and 3rd terga; 1st tergum dull black, white pilose; 2nd tergum dull (pollinose), with large yellow macula on medial 2/3, with macula slightly rounded on apicolateral half, white pilose on basal 4/5 except laterally, black pilose laterally and apically, except on basolateral corner long white pilose; 3rd tergum dull (pollinose), entirely black pilose; 4th tergum dull (pollinose) except shiny apically on apical 1/3 with submedial triangular extension to basal 1/2, black pilose except white pilose laterally. Genitalia: black, shiny, black pilose; surstyli C-shaped with basal protuberances and large central lobe (Figs 2A, C); postgonite kidney-shaped with stubby dorsal and distal prongs (Fig. 2B).

Female. Similar to the male except as follows: frons black, shiny except for two white pollinose maculae at mid length, black pilose; abdomen entirely black, dull pollinose except shiny where male yellow maculae are, white pilose lateral and on shiny area, elsewhere black pilose; 5th tergum black, shiny, black pilose.

Larva and puparium. Larva uniform olive-green without markings; mandibular hook three-lobed; posterior respiratory siphon 2.5 times as long as wide, darkly sclerotised on distal half (Fig. 3A-F).

Etymology. The epithet is the combination of 'formica' for ant and 'phila' for lover of. The name is an adjective.

Distribution. Australia (New South Wales, Queensland) (Fig. 4).

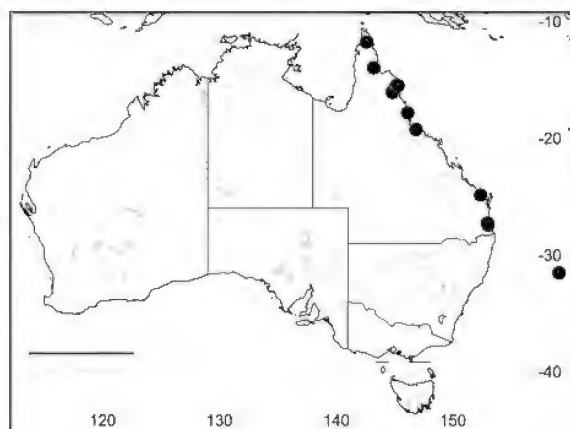


Fig. 4. *Trichopsomyia formiciphila* distribution. Scale bar = 1000 km.

Remarks. This species is readily recognized as the only *Trichopsomyia* known from Australia. It is similar to an undescribed species from Indonesia (a single male specimen from Kuala Lumpur collected by Pendlebury is in the American Museum of Natural History) and both species differ from other *Trichopsomyia* by the swollen and arcuate metatibia with a distinct thick brush of pile. They are mimics of stingless (trigonid) bees. *Trichopsomyia formiciphila* sp. n. has been reared in association with weaver ants of the subgenus *Polyrhachis* (*Cyrtomyrma*) Forel (Hölldobler and Wilson 1990: 510). The material collected by Hölldobler and Wilson should be in the Museum of Comparative Zoology but the specimens are missing and thus could not be included in the type series. Six specimens were DNA barcoded to test the species concept (COI 5' gene sequenced). QMT222894 and QMT222901 from the Brisbane area in South Queensland differed by only a single base pair from specimens collected near Mission Beach in North Queensland (CNC374740, CNC374747, CNC385009 and CNC385010). The Lake Eacham larva (CNC583572) was identical to sequences of Mission Beach adults. Sequence data could not be obtained from specimens from Cape York or Townsville (DNA degraded).

Table 1. Collection data for *Trichopsomyia formiciphila* puparia (and 1 larva) obtained from nests of the weaver ant *Polyrhachis australis* in Townsville. Volumes (cm³) are of the ants' nests. Puparium sizes (mm) are given with and without respiratory horns respectively. NR = not recorded.

DATE	HOST PLANT	VOLUME	SPECIMEN	SIZE
29.09.09*	Umbrella	60	Puparium**	7.3, 6.9
18.10.09	NR	216	Puparium	8.9, 8.0
19.11.09	NR	240	Puparium	8.0, 7.0
08.01.11*	Umbrella	127.5	Puparium	7.6, 7.4
08.01.11	Umbrella	127.5	larva	(5.0)
11.02.11	NR	10.5	Puparium	7.0, 6.8
10.12.11.	Palm	8	Puparium	7.0, 6.7
19.01.12*	NR	192	Puparium	7.5, 7.3
19.01.12*	NR	192	Puparium	7.5, 7.0
19.01.12*	NR	192	Puparium	7.4, 6.8
05.10.13	Palm	8	Puparium	7.8, 7.0
22.12.13	Palm	13	Puparium	7.0, 6.7
10.07.14*	Palm	16	Puparium	7.6, 6.9

*Material taken by JHS for DNA analysis, stored in CNC; **Unbreached: dry remains of larva within.

Biology. In nests of the arboreal weaver ant *Polyrhachis australis* Mayr from Cranbrook, Townsville (19.302S, 146.751E), the inquiline's larvae were probably brood predators and its puparia were typically located on the innermost side of the nest wall, *i.e.* close against the silk lining of the nest carton, or on the inside of the leaf forming a nest wall, but were sometimes positioned deeper inside the nest or outside. All puparia occurred singly with one exception, when three were found in the same nest (19/1/12, Table 1). The host plants (umbrella tree and palms) primarily reflect the relative abundance of these plants and the ants' preferred host plants for their nests, rather than any propensities of the syrphids themselves. The dates of collection suggest greater activity in the summer (wet season) months but further specimens are needed to confirm this. Since only two of the puparia contained a larva and the rest were empty, a short metamorphic period is suggested. Again, future collections are needed to substantiate this. Some of the puparia appeared to be held to the substrate by an aggregate of silk strands forming a sheet (Fig. 3F).

Acknowledgements

The order of the authors is alphabetical, all contributing equally to the manuscript: Downes collected the larvae, biological notes and associated data and contributed the larval figure; Skevington collected many of the adults, assembled the material examined, prepared the figures and coordinated the molecular data analysis; and Thompson contributed the traditional taxonomy.

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**A NEW SUBSPECIES OF *DELIAS CALIBAN* GROSE SMITH, 1897
(LEPIDOPTERA: PIERIDAE) FROM NORMANBY ISLAND,
D'ENTRECASTEAUX GROUP, PAPUA NEW GUINEA**

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Abstract

A review of *Delias caliban* Grose Smith, 1897, endemic to the D'Entrecasteaux Islands, Milne Bay Province, Papua New Guinea, is presented. Primary type material of nominotypical *D. c. caliban* (TL: Fergusson) and of *D. c. satsibona* Rothschild, 1915 (TL: Goodenough) is illustrated. A new subspecies, *D. c. sycorax* **subsp. n.**, from Normanby Island, is described and illustrated. A lectotype is designated for *D. c. satsibona* Rothschild. Current dangers and difficulties for travellers to the D'Entrecasteaux are briefly discussed.

Introduction

The pierine genus *Delias* Hübner, 1819, ranges from Sri Lanka and India in the west to the Solomon Islands, New Caledonia and Vanuatu in the east, attaining its greatest diversity in the mountains of mainland New Guinea. Some 255 species are currently recognised (Müller *et al.* 2013) and the genus has received revisionary – or at least a comprehensive – treatment by a number of authors, notably Talbot (1928–1937), Roepke (1955) and, most recently, Yagishita *et al.* (1993) and Müller *et al.* (2013).

Many *Delias* are moderate to high elevation species, including *D. caliban* Grose Smith, 1897, described from Fergusson Island in the D'Entrecasteaux group. *Delias caliban* is morphologically very similar to *D. ladas* Grose Smith, 1894, a fact acknowledged by Grose Smith (1897), who nevertheless considered it a distinct taxon: '*D. caliban* is a much larger insect than *D. ladas*; the irrorated yellow basal area on the underside of the posterior wings is a very distinct feature, apart from other differences.' A second *D. caliban* subspecies, *D. c. satsibona* Rothschild, 1915, was described from Goodenough, the adjacent island northwest of Fergusson. Talbot (1937) treated *D. caliban* as a distinct species, while Roepke (1955) listed it as *D. ladas caliban* and offered the opinion 'treated by its author and Talbot as a separate species, but apart from the larger size, the male is identical with *ladas* (Toxopeus ms.)'. *Delias ladas*, to which *D. caliban* does bear some superficial resemblance, is widespread on the New Guinea mainland. Both Yagishita *et al.* (1993) and Parsons (1998) treated *D. caliban* as a distinct species; it differs from all subspecies of *D. ladas* in its larger size, yellow basal area on the underside of the hind wing and the yellow submarginal spots on the underside of the female hind wing (Chris Davenport in litt.). Müller *et al.* (2013) found less than 1% difference in CO1 gene sequence between *D. caliban* and *D. ladas* (Chris Müller in litt.).

It is widely believed that only two male specimens of nominotypical *D. c. caliban* exist (Grose Smith 1897, Parsons 1998). However, the Natural

History Museum (BMNH) in London actually has three males collected by A.S. Meek; the holotype and one paratype from the Rothschild collection taken in 1894 (see below) and a third male, which was also collected by Meek; it bears no date, but since it is ex-H H Druce and ex-Joicey was almost certainly collected at the same time as the other two. Although not illustrated by Grose Smith when he described it, *D. caliban* was illustrated by Grose Smith and Kirby (1897: p. 26, pl. 'Papilionidae. Pierinae. *Delias* VII', figs 6-7); the painting on the plate accurately depicts the upper surface, although the under surface basal area is a rather bright lemon-yellow and extensive on the painting. In both historical and fresh specimens in the BMNH the yellow may appear to be tinged greenish, especially when the dusting of yellow scales is light; the second of the two Rothschild collection male specimens (the original description noted 'two examples were in the collection' [Grose Smith, 1897]) has much less basal yellow. Grose Smith and Kirby's illustration also has an exaggerated 'finger' of dark border colour intruding into the underside forewing white basal area.



Figs 1-3. *Delias caliban caliban* holotype male: (1) labels; (2) upper surface; (3) under surface.

Notwithstanding some artistic licence, this illustration is clearly the specimen also labelled as the 'Type' in what is almost certainly Grose Smith's own handwriting (Fig. 1) and is taken to be the holotype. The example of his handwriting provided by Horn *et al.* (1990) is not helpful, since it does not include examples of most of the letters used on the *caliban* label; it is also noted that Horn *et al.* (1990: 148, 466 [the latter with incorrect initials])

used a hyphenated form of Grose Smith's name, a mistake made by very many authors but never by Grose Smith himself. The *caliban* label (Fig. 1) does not hyphenate Grose Smith's name.

The current edition of the ICZN (1999) Code requires a holotype to be designated in the written description and that, if this is not the case, a lectotype should be designated. However, it is rather enigmatic – or at least open to a measure of interpretation – on the subject of type material prior to 2000; Recommendation 73F declares that 'where no holotype or syntype was fixed for a nominal species-group taxon established before 2000, and when it is possible that the nominal species-group taxon was based on more than one specimen, an author should proceed as though syntypes may exist and, where appropriate, should designate a lectotype rather than assume a holotype'. The word 'assume' is taken here to be important: although no holotype was formally designated in the case of nominotypical *D. c. caliban* in Grose Smith's written description, his illustration very obviously refers to the specimen which bears his own handwritten 'Type' label. Arguably, there is no 'assumption' to be made – this is the specimen which Grose Smith clearly considered to be the name-bearing Type and it is taken here to be a holotype; under these circumstances it is arguably unnecessary and arrogant to override the clear action and intentions of the original author. It is acknowledged that this may not meet with universal approval; it is a potentially sensitive issue and one which might be addressed in time by the ICZN. The second male from the Rothschild collection has been labelled as a paratype.

Delias caliban satisbona was described by Rothschild in 1915 and was, like nominotypical *D. c. caliban*, collected by A.S. Meek. It differs fundamentally from nominotypical *D. c. caliban* in the hindwing underside having much reduced greenish yellow scales basally. Rothschild (1915) made no reference to the number of specimens before him, although Parsons (1998) erroneously declared: 'To date, [nominotypical] *caliban* is known by 2 ♂♂ and *satisbona* by 4 ♂♂ and 4 ♀♀'. There are indeed four pairs of *D. c. satisbona* in the Rothschild collection in the BMNH and one of these males is labelled as the 'type', although the word 'type' appears to have been added to the label as an afterthought, probably in a different hand (Fig. 4). However, there are a further 5 ♂♂ and 3 ♀♀ in the main collection, all bearing the same black bordered Goodenough / Meek label as those in the Rothschild collection. Since this series came to the BMNH from the Joicey collection, not the Rothschild collection, identical labelling might be considered unusual, but there is evidence to suggest that when Meek material was received by Rothschild at Tring Museum, it was not unusual for Tring to take a selection of specimens (in the case of what was to become *D. caliban satisbona*, four pairs) and label the remainder before they were passed to dealers for sale. One of the Joicey males carries a further handwritten label: 'D. Satisbona Roths. Det. Roths. Cotype', and a female bears the same 'Cotype' data, but not 'Det. Roths.'. It is possible that Rothschild had access to the Joicey

material and that the whole of this series (nine males and seven females) could be considered syntypic, but the words 'Det. Roths.' (i.e. 'determined [by] Rothschild') leave some doubt as to whether this labelling was done at the time of Rothschild's description, or at some later date. Because there is an element of doubt, the Joicey material is excluded and syntypes are assumed only to include the four pairs in Rothschild's collection.



Figs 4-8. *Delias caliban satisbona*: (4) LT ♂, labels; (5) LT ♂, upper surface; (6) LT ♂, under surface; (7) PLT ♀, upper surface; (8), PLT ♀, under surface.

In order to fix current application of the name, a lectotype for *D. c. satisbona*, with the following labels, is hereby designated: (1) printed, black bordered label 'Goodenough Isl[and], 2500-4000 f[ee]t, May 1913. A. S. Meek.'; (2) handwritten '*Delias caliban satisbona* Type Rothschild.'; (3) printed circular, purple bordered label 'LECTOTYPE'; (4) printed, 'LECTOTYPE, *Delias caliban satisbona* Rothschild, 1915, designated by John Tennent, 2017'. Seven paralectotypes (3 ♂♂, 4 ♀♀) are designated with the following labels: (1) printed, black bordered label 'Goodenough Isl[and], 2500-4000 f[ee]t, May 1913. A. S. Meek.'; (2) printed circular, pale blue bordered label 'PARALECTOTYPE'; (3) printed, 'PARALECTOTYPE, *Delias caliban satisbona* Rothschild, 1915, designated by John Tennent, 2017'.

The scarcity of *D. caliban* in museum collections almost certainly reflects complications in reaching the species' habitat due to difficulty of the terrain, land ownership issues and cost, rather than scarcity of the butterfly. Parsons (1998) stated that the known elevational range of *D. caliban* was from about 760 to 1,220 m. The present author has observed *D. caliban* on both Goodenough and Fergusson; Parsons' estimate of altitudinal range is probably quite accurate at the lower end but *D. c. satisbona* occurs at least as high as the summit of 'Oiamadawa'a at 2,160 m on Goodenough. The species appears common on both islands but is not an easy butterfly to catch. Individuals fly deceptively slowly but cover a lot of ground and rarely rest. Specimens (now deposited in BMNH, London) were captured on Goodenough but on Fergusson the butterfly was not seen in six days spent on the summit of 'Oiatabu (Mount Kilkerran) and, although it was seen frequently in the forest lower down the mountain, observations were invariably made from a distance. The female of the nominate race remains unknown.

The author spent five days and nights on the summit of Mount Pabinama on Normanby Island, the most southerly of the three large islands of the D'Entrecasteaux, from where *D. caliban* has not previously been recorded. The species, in an undescribed form, was not uncommon in all habitats above ca 750 m, including the summit of Mount Pabinama. This is described here as a new subspecies.

New taxon

Delias caliban sycorax subsp. nov.

(Figs 9-14)

Type material: (2 ♂♂, 4 ♀♀). *Holotype* ♂, PAPUA NEW GUINEA: Milne Bay Province, Normanby Island, Mount Pabinama, camp three, 842 m, 10°04'50.8 S / 150°59'56.2 E, 3 November 2016, John Tennent (in BMNH). *Paratypes*: 1 ♂, same data as holotype; 1 ♀, Mount Pabinama, below summit, 950-1,000 m, 10°04'43.5 S / 150°00'20.9 E, 3 November 2016, John Tennent; 1 ♀, Mount Pabinama, summit, 1,045 m, 10°04'55.9 S / 150°00'15.1 E, 29 October 2016; 1 ♀, ditto, 1 November 2016, John Tennent; 1 ♀, ditto, 2 November 2016, John Tennent (all in BMNH).



Figs 9-13. *Delias caliban sycorax* subsp. n. (9) HT ♂, labels, (10) HT ♂, upper surface; (11) HT ♂, under surface; (12) PT ♀, upper surface; (13) PT ♀, under surface.

Description. Male (Figs 10-11) forewing length 34 mm, very similar to other races of *D. caliban*. Upperside: forewing ground colour white, outer third black, basal edge of black border regular (more irregular in nominotypical *caliban*); hind wing white with fine black border (border broader in nominotypical *caliban* and *D. c. satisbona*). Underside: forewing outer half black, with one distinct subapical spot and two smaller yellow streaks

(similar arrangement, but placed slightly further from the margin in nominotypical *caliban* and *D. c. satisbona*; reduced to one spot, vestigial or absent in *D. c. satisbona*); hind wing black, with sulphur yellow basal area extending over almost one third of the wing (yellow scales more dense in nominotypical *caliban*; often significantly reduced or almost absent in *D. c. satisbona*); small but distinct yellow spot in space 6, almost touching margin (spot also distinct, but placed further from margin in nominotypical *caliban*; vestigial or absent in *D. c. satisbona*).



Fig. 14. *Delias caliban scyorax* female at rest on leaf, Normanby Island, Mount Pabinama, ca 800 m (photo: David Mitchell).

Female (Figs 12-14) similar to *D. c. satisbona* (the nominotypical *D. c. caliban* female remains unknown). Upperside: forewing basal area white, dusted lightly with grey scales (white area usually slightly more extensive and widely dusted with yellow scales in *D. c. satisbona*); distinct subapical yellow spots in spaces 5 and 6 (spots placed further from the wing margin in *D. c. satisbona*); hind wing with basal whitish grey area extending over approximately half the wing, dusted lightly with yellow scales (basal area yellow, occupying less than half the wing in *D. c. satisbona*). Underside: forewing basal area plain white with a scattering of grey or indistinct yellow scales, white patch extending along inner margin almost reaching tornus (white area reduced, with wide, distinct area of pale yellow scales on costal

edge; extending half way to tornus in *D. c. satisbona*); slightly curved series of subapical yellow spots and streaks (variable) (spots often larger, placed further from apex in *D. c. satisbona*); hind wing black, with dusting of yellow scales basally and along inner margin and costa; distinct yellow submarginal spot in space 6 and series of smaller, more linear streaks in spaces 1b–5, 7 (variable in number and extent) (markings also variable, placed further from wing margin in *D. c. satisbona*).

Diagnosis. Differences between the three races of *Delias caliban* are relatively minor, but appear constant. Placement (nearer the wing margin) of the yellow subapical and submarginal spots of *D. c. sycorax* serve to separate it from both nominotypical *D. c. caliban* and *D. c. satisbona*. The female of nominotypical *D. c. caliban* has not yet been collected but the extent of the white basal areas on both surfaces of *D. c. sycorax* and, in particular, the lack of upperside yellow suffusion in comparison with the heavily suffused female of *D. c. satisbona* are diagnostic. It will be interesting to see the phenotype of nominotypical *D. c. caliban* in due course.

Distribution. The island of Normanby, D'Entrecasteaux group, Papua New Guinea (Milne Bay Province).

Etymology. The name *caliban* was presumably taken from the name of the main antagonist in Shakespeare's *The Tempest*, set on a remote island; the unseen Sycorax was the mother of Caliban.

Discussion

This short paper is an integral part of research into the distribution and systematics of the butterflies of Milne Bay Province islands, Papua New Guinea, carried out by the author between 2010 and 2016. The D'Entrecasteaux are substantial, high islands, close to the New Guinea mainland and, while the butterflies of the islands have been documented elsewhere (*e.g.* Parsons 1998), previous records have mainly been concentrated on lowland localities.

It is interesting to note that the 5th Archbold Expedition visited Mount Pabinama in 1956, arriving at a camp site below the summit on 30 April with 43 carriers, but that following a stay of 12 days (Brass 1959) they regarded the mountain as being unsuitable for butterflies: '[on Mount Pabinama] ... insect collecting could only be described as poor ... habitat conditions were unsuitable for most butterflies ...' (Brass 1959: 43).

The author's own experience was quite different; heavy rain was experienced for the first two days and nights but when the sun emerged on the third day butterflies were both diverse and plentiful on and around the summit. This disparity is not surprising; it is not unusual for researchers to experience completely different conditions and species at different times when working in the tropics.

Issues in reaching altitude on all the islands of the D'Entrecasteaux (and on other islands of Milne Bay) include the fact that land ownership on the islands can be complex and that authority must be obtained from relevant landowners before venturing inland. There are few villages any distance from the coast and it is inconceivable that a visitor can gain any height without local assistance.

It should be noted that in recent years a threat has arisen in the islands. The waters around the D'Entrecasteaux have witnessed many acts of piracy and the activities of criminals (euphemistically referred to locally as 'rascals'), largely from the area of West Fergusson, now encompass coastal areas of all the main islands of the D'Entrecasteaux and further afield. Theft of dinghies and powerful outboard motors have enabled criminals to attack coastal trade stores and steal cash and provisions at gunpoint – and in the past two years two policeman have been shot and killed by these gangs. Despite being very careful not to forewarn local people of our arrival, the author came very close to being caught by a group of these criminals when leaving the summit of Pabinama on 3 November 2016; having just left one of the lower camps *en route* for the coast, a group of criminals were seen by our carriers, heading up from the same camp a short time later, having approached from a different part of the island. Plans were altered and instead of an overnight river stopover as planned, we reached the coast as dusk fell and left Normanby early the following morning. Further criminal activity in the area of East Cape at Christmas 2016 made safe dinghy travel between the mainland and the D'Entrecasteaux islands impossible. No doubt these issues will be resolved in due course but, for the moment, the authorities seem unable to stop these activities and further escalation seems inevitable.

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A NEW SPECIES OF *COPELATUS* ERICHSON, 1832 (COLEOPTERA: DYTISCIDAE: COPELATINAE) FROM THE ADELBERT RANGE OF PAPUA NEW GUINEA

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Abstract

We describe *Copelatus adelbert* sp. n., the first member of the *Copelatus hydroporoides* group from the Australian Region. The species is endemic to the Adelbert Range in Papua New Guinea. In addition to lacking striae on elytra (character of the *C. hydroporoides* group), *Copelatus adelbert* sp. n. is very characteristic due to its colouration, with bright contrasting transversal, basal and apical orange bands on the otherwise dark elytron. Habitus and median lobe of the new species are illustrated and notes on the habitat are provided.

Introduction

The diving beetle genus *Copelatus* Erichson, 1832, is a diverse group of aquatic insects with more than 400 described species (Nilsson 2016) and a mainly pantropical distribution. For the identification of *Copelatus* species, it is often necessary to use, more or less, a combination of three character groups: (1) the shape of the median lobe of the aedeagus; (2) the pattern of surface sculpture and punctation, in particular the number of elytral striae, which has been used to establish species groups (see Sharp 1882, Guignot 1961, Guéorguiev 1968, catalogue: Nilsson 2016); and (3) the shape of the male protibia (Megna and Epler 2012). In some cases, identifications are augmented with the general habitus of the species and the body size. *Copelatus* has not yet been firmly justified as a monophyletic group based on morphological apomorphies. Recent molecular phylogenetic work suggests that this large genus might indeed be one radiation but, at the same time, it emerged that the number of elytral striae is highly variable within clades so that the species groups in current use are not monophyletic (Balke *et al.* 2004).

Species lacking elytral striae are currently assigned to the *Copelatus hydroporoides* group (see Hájek *et al.* 2010). No species of the *C. hydroporoides* group has been recorded previously from the Australian Region (hitherto known from the Afrotropical and Neotropical Regions as well as Wallacea (Hájek *et al.* 2010)). Here we describe its first species from the region, from Papua New Guinea.

Material and methods

This study is based on the examination of nine specimens, which are deposited in: NARI – PNG National Insect Collection, Port Moresby, Papua New Guinea; BMNH – Natural History Museum, London, UK; ZSMM – SNSB-Zoologische Staatssammlung, München, Germany.

All specimen data are quoted as they appear on the labels attached to the specimens. Label text is cited using quotation marks. Our red identification labels were attached to the types.

Photos and illustrations. The beetles were studied with a Leica MZ 12.5 stereo microscope at 10-100x. Drawings were digitally inked based on digital images using Corel Draw Graphics Suite X6. Images of the habitus was taken with a digital imaging system, composed of a Canon 5DS camera with Nikon bellows, a Thorlabs iris and 2x ELWD Plan Apo objective attached to a Mitutoyo focus lens. Image stacks were generated using a StackShot macro rail and images assembled with the computer software Helicon Focus 4.77TM.

Morphological observations. Six specimens were measured. In the descriptions and diagnoses, measurements are given as a minimum-maximum range followed by the mean. The following abbreviations are used for body measurements: EL – elytral length (along midline from anterior margin to apex); EW – elytral width (across greatest transverse width of both elytra combined); HL – head length (along midline from the anterior clypeal margin to the anterior pronotal margin); HW – head width (maximum width near posterior margin of the head); PL – pronotal length (along midline from anterior to posterior margin); PW – pronotal width at level of posterior margin; TL – total length (TL = HL+PL+EL). Finally, general body shape was quantified with the ratios PL/PW and TL/EW.

Copelatus adelbert sp. n.

(Figs 1-2)

LSID: urn:lsid:zoobank.org:pub:E91FB1D6-968C-4633-B805-9E0A9D8871C2.

Type locality. Keki birdwatching area in the Adelbert Mountains, Madang, Papua New Guinea, at 04°42'215"S, 145°25'154"E.

Type material. *Holotype* ♂, 'Papua New Guinea: Madang, Adelbert Mts., Sewan - Keki, 700 m, 04°42'215"S, 145°25'154"E, 4.v.2006, leg Balke & Manaono (PNG 51)' (in ZSM). *Paratypes:* 3 ♂♂, same data as holotype (ZSM; BMNH); 1 ♀, 'Papua New Guinea: Madang, Adelbert Mts., Keki, 850 m, 04°42'300"S, 145°25'089"E, 4.v.2006, leg Balke & Manaono (PNG 52)' (ZSM); 1 ♂, 'Papua New Guinea: Madang, Adelbert Mts., below Keki, 790 m, 04°42'300"S, 145°25'089"E, 5.v.2006, leg Balke & Manaono (PNG 53)'; 1 ♂, 2 ♀♀, 'Papua New Guinea: Madang, Adelbert Mts., creek nr Keki, 790 m, 04°42'300"S 145°25'08"9E, 28.xi.2006, Binatang Research Center team leg. (PNG 53a)' (ZSM; NARI).



Fig. 1. *Copelatus adelbert* sp. n.: photo of habitus in anterior-dorsolateral view to illustrate colouration of dorsal surface (Paratype, total length 6.3 mm).

Diagnosis. Medium sized, with smooth pronotum and elytra in both sexes; with conspicuous bright orange bands on roughly anterior and posterior thirds of elytron; median lobe of aedeagus of complex type, composed of several sclerites. Based on the lack of dorsal striae or striae, this species belongs to the *Copelatus hydroporoides* group, which has 51 species globally (Nilsson 2016). The only species known from the eastern Old World is the Oriental *C. sibelaemontis* Hájek *et al.*, 2010, from the Moluccas, which differs from the new species by the much darker colouration, shape of the male genitalia and, with a TL 4.6–5.0 mm, a smaller size than *C. adelbert* sp. n. (> 6.0 mm).

Description. Male. Habitus (Figs 1–2a). Body oval, slightly attenuated posteriorly, dorsoventrally depressed; broadest near mid length; lateral outline continuous in dorsal aspect.

Measurements and ratios (minimum–maximum, mean), in mm (n = 4): HL 0.4–0.5, 0.5; HW 1.7–1.8, 1.7; PL 0.7–0.8, 0.8; PW 2.8, 2.8; PW/PL 0.4, 0.4; EL 5.0–5.2, 5.1; EW 3.1–3.2, 3.1; TL/EW 2.0–2.1, 2.0; TL 6.3–6.4, 6.3.

Colour. Head orange. Pronotum very dark brown to blackish, anteriorly paler, laterally orange. Elytra very dark brown to blackish, with orange band covering about one quarter of the elytra at the base, and about one third of the elytra at the posterior end (Figs 1–2a). Venter very dark brown to blackish.

Sculpture and punctation. Entire dorsal side with fine, widely spaced punctures. Pronotum with transverse row of coarser punctures along base; posterior margin less densely punctate. Elytra with three longitudinal rows of widely spaced punctures generally extending to apex, one extending parallel to elytral starting at around base meeting the corner of scutellum. Metaventre with transverse wrinkles on either side of median ridge.

Metacoxal plate with short striae, more or less longitudinal anteriorly but pointing slightly towards metacoxal process posteriorly. Abdominal ventrites with striae. Last ventrite with one short row of numerous long setae towards edges.

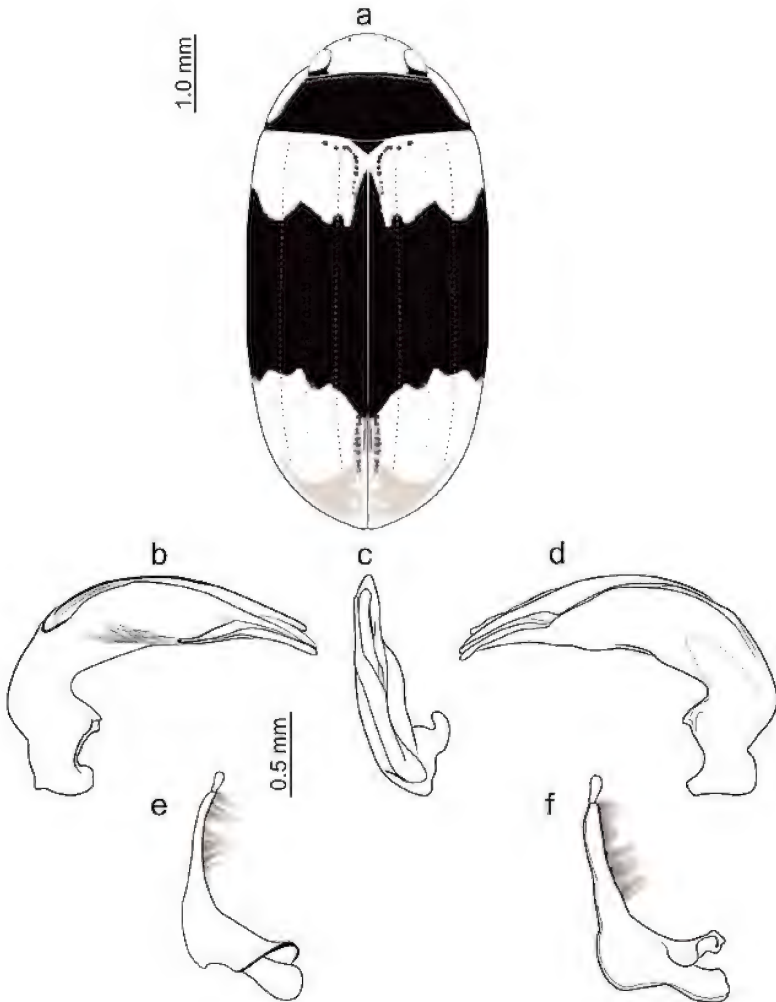


Fig. 2. *Copelatus adelbert* sp. n.: (a) male habitus; (b) median lobe in left lateral view; (c) same in ventral view; (d) same in right view; (e) right paramere in lateral view; (f) left paramere in lateral view.

Structure. Antennae not modified, filiform. Prosternal process without setae, lanceolate and slightly convex, not reaching middle of mesocoxal cavity. Prosternum with setae on either side, long on central part of base and shorter either side. Protibia without ventrobasal emargination (not arcuate). Protarsus with five rows of setae bearing suction palettes (total 24 palettes). Protarsomere V slightly concave ventrally with notch at posterior edge and central band of dense short setae from anterior to posterior edges.

Median lobe of aedeagus broadened in middle part, with apex strongly modified (Figs 2b-d); parameres narrow, with inner margin setose at midlength (Figs 2e-f).

Female. Same as male but with protarsomeres not bearing suction palettes. Female measurements and ratios (minimum-maximum, mean), in mm ($n = 2$): HL 0.4, 0.4; HW 1.7, 1.7; PL 0.7, 0.7; PW 2.7, 2.7; PW/PL 0.4, 0.4; EL 4.8-5.0, 4.9; EW 3.0, 3.0; TL/EW 2.1, 2.1; TL 5.9-6.1, 6.0.

Distribution. The species is endemic to the Adelbert Mountains in Papua New Guinea (Fig. 3).

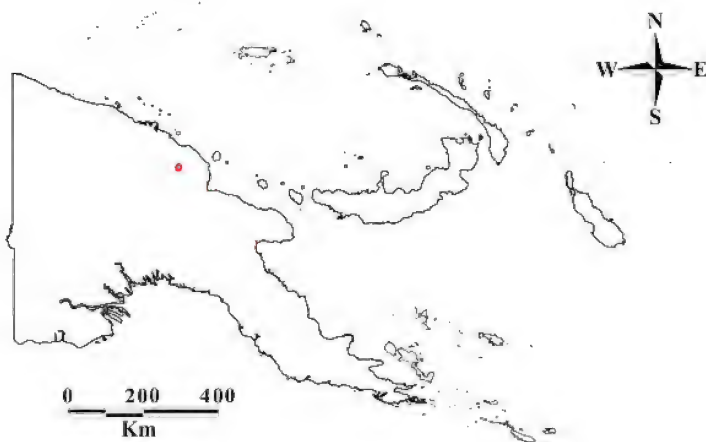


Fig. 3. Distribution of *Copelatus adelbert* sp. n. in Papua New Guinea.

Habitat. Collected from small puddles along forest creeks; the ground was red clay with sand, gravel and sometimes leaves (Fig. 4). Other aquatic beetles present were Hydraenidae, Hydrophilidae and Dytiscidae: genus *Exocelina* Broun.

Etymology. Named after the Adelbert Mountain Range where the species was discovered. The name is a noun in the nominative singular standing in apposition.



Fig. 4. Habitat of *Copelatus adelbert* sp. n., stream setting around Keki Lodge and small puddle at the edge of the streambed which is inhabited by the beetles.

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BOOK REVIEW

Keys to the tropical fruit flies (Tephritidae: Dacinae) of South-East Asia by R.A.I. Drew and M.C. Romig. CAB International, Wallingford, November 2016, vii + 487 pp. Hardback. ISBN-13: 978 1 78064 419 6. Price £125.

This volume, a companion to the same authors' 2013 'Tropical fruit flies of South-East Asia' contains identification keys to the 423 known species of the tephritid fruit fly genera *Bactrocera*, *Dacus*, *Ichneumonopsis* and *Monacrostichus* recorded from South and Southeast Asia as far east as northwestern New Guinea.

The Introduction contains one of the most important aspects of this volume – a comprehensive rejection of the recently proposed synonymy of *Bactrocera invadens* Drew, Tsuruta & White and *B. papayae* Drew & Hancock with *B. dorsalis* (Hendel), with the first two properly returned to species status. This section ably highlights the danger of relying too heavily on limited and incomplete molecular data at the expense of morphological and biological information, which provide better insights into species limits within the Dacinae, especially in difficult groups such as the *dorsalis* complex. One new synonymy is proposed in subgenus *Zeugodacus*, with the latter's recent elevation to genus also rejected. This is followed by a table detailing the known lure responses (cue, methyl eugenol, 'other' or unknown) for all recognised species.

A section illustrating in detail the morphological characters used in the keys precedes the main section of the book: the profusely illustrated dichotomous keys to genera, subgenera and, in some cases, species complexes. The morphological section includes (Fig. 5) illustrations of scutal variation within *B. invadens*, providing further assistance in separating this very variable species from the less variable *B. dorsalis*. The illustrations within the keys are as informative as those used in several (now outdated) computer-based keys (but more user-friendly) and a high degree of success in identification is attainable even for users not skilled in dacine taxonomy.

Separate keys are provided for the *dorsalis* and *nigrotibialis* complexes in subgenus *Bactrocera* and the *scutellaris* and *tau* complexes in subgenus *Zeugodacus*. Although the *dorsalis* complex still remains difficult and in some cases might require several specimens to be sure, the keys in this volume are the most reliable way of identifying some of the World's most serious and invasive horticultural pests. I found only one (minor) error: the Moluccan species *B. (Asiadacus) absoluta* (Walker) has supra-alar setae present and will run near *B. (Parasinodacus) eurylomata* (Hardy).

The book concludes with a list of references and an appendix detailing subgeneric changes made since the 2013 volume (more are in progress). The taxonomic placements in the 2013 volume have been retained in the present one so as to enable consistency and ready accessibility of the more detailed information (descriptions, distributions and host plants) provided in the former.

This is a worthy companion to the authors' 2013 volume and will form an indispensable part of the library of any person or Organisation involved in dacine taxonomy, identification and, particularly, biosecurity. It is highly recommended.

Reviewed by D.L. Hancock, Cairns

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